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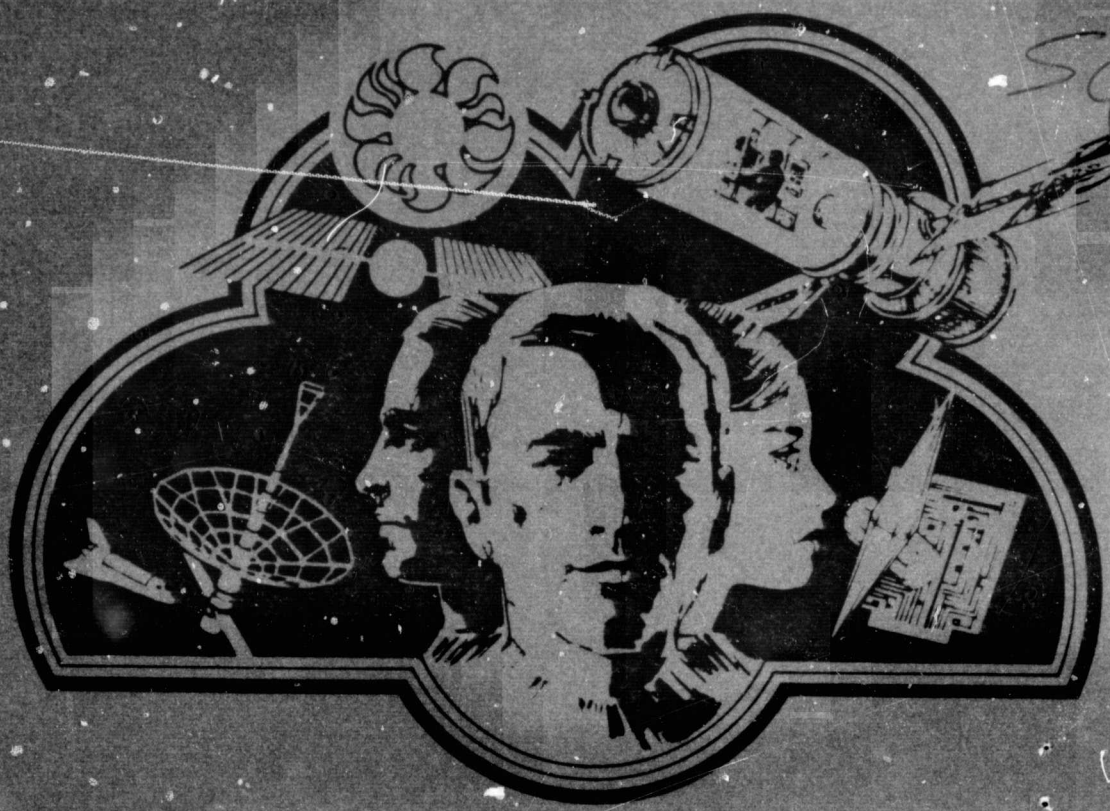

SPACE STATION SYSTEMS ANALYSIS STUDY
PART 3: DOCUMENTATION

VOLUME 5
Cost and Schedule Data

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SPACE STATION SYSTEMS ANALYSIS STUDY

PART 3: DOCUMENTATION

VOLUME 5
Cost and Schedule Data

JULY 1977

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CONTRACT NO. NAS 9-14958
DPD NO. 524
DR NO. MA-04

APPROVED BY:

C. J. DaROS
STUDY MANAGER, SPACE STATION STUDY

PREPARED FOR: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHNSON SPACE CENTER
HOUSTON, TEXAS

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY-WEST
5301 Bolsa Avenue, Huntington Beach, CA 92647

PREFACE

The Space Station Systems Analysis Study is a 15-month effort (April 1976 to June 1977) to identify cost-effective Space Station systems options for a manned space facility capable of orderly growth with regard to both function and orbit location. The study activity has been organized into three parts. Part 1 was a 5-month effort to review candidate objectives, define implementation requirements, and evaluate potential program options in low earth orbit and in geosynchronous orbit. Part 2 was also a five-month effort to define and evaluate specific system options within the framework of the potential program options developed in Part 1.

Part 3, the last portion of this study, defines a series of program alternatives and refines associated system design concepts so that they satisfy the requirements of the low earth orbit program option in the most cost-effective manner.

The final reporting of the Part 3 study activity consists of the following:

Volume 1, Executive Summary
Volume 2, Technical Report
Volume 3, Appendixes
Book 1, Supporting Data
Book 2, Supporting Data
Volume 4, Supporting Research and Technology Report
Volume 5, Cost and Schedules Data

A complete list of Parts 1 and 2 tables of contents are included for references in Volume 3, Book 2 in Section 17 of the appendix.

During this study, subcontract support was provided to the McDonnell Douglas Astronautics Company (MDAC) by TRW Systems Group, Aeronutronic Ford Corporation, the Raytheon Company, and Hamilton Standard.

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Questions regarding the study activity or the material appearing in this report should be directed to:

Jerry W. Craig, EA 4
Manager, Space Station Systems Analysis Study
National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, Texas 70058

or

C. J. DaRos
Study Manager, Space Station Systems Analysis Study
McDonnell Douglas Astronautics Company-West
Huntington Beach, California 92647
Telephone (714) 896-1885

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Section 1
INTRODUCTION

During Part I of the Space Station Systems Analysis Study (SSSAS) schedule data and estimates of relative costs were compiled for each of the 56 different program options. Special emphasis was placed on using methodology and procedures that identified the difference in costs between each of the various program options. The emphasis was on relative rather than absolute costs.

The MDAC Modular Space Station (MSS) Study was the major base for the costs assigned to the Space Station modules and mission hardware items. The cost of each hardware element in the MSS study was computed separately and recorded in a list of standard costs. These standard costs were then used as building blocks to assemble the cost of each program option. However, these costs were supplemented and modified by data from other sources, including: data generated during the Manned Orbital Systems Concept (MOSC) study; data obtained from the Skylab program; information from the MDAC data bank, including factors and ratios traditionally used by MDAC; costs derived from structure cost estimating relationships (CERs) in the MDAC data bank; costs taken from Outlook for Space; costs derived from best judgment estimates; and NASA furnished costs.

During Part II of the SSSAS costs were estimated for six different programs. In Part II there was a radical departure from the method of determining costs that was used in Part I. Per NASA directive it became a requirement to use NASA JSC MSS Phase B costs as the major base for determining costs. This approach necessitated the requirement for a new set of building block costs which were described in detail in the Part II report. All the module costs and portions of other hardware costs were obtained using these building block costs. MDAC costing methods and data were used in those instances where new hardware was involved and where the building blocks costs were not applicable.

Similarly the floating items such as project management, systems test and GSE were calculated using the ratios determined from the above study. These ratios were assumed to be constant over the range of program costs considered in Part II except for the test hardware.

During Part III the costs were estimated for a selected program. The method used for estimating costs was similar to that used in Part II. However, during Part III a larger proportion of the estimates were derived from the MDAC data base. This shift reflected the change in design approach during Part III. The design emphasized maximizing the use of existing hardware (from such programs as Orbiter, SEPS and Spacelab) and concentrated on driving hard to decrease both the complexity and the number of modules in the construction and support portion of the station. The success achieved in accomplishing this goal is reflected in the decreased size of the WBS diagram for Part III – see Section 5 of this report.

Section 2
PROGRAM DESCRIPTION

2.1 BLOCK DIAGRAM

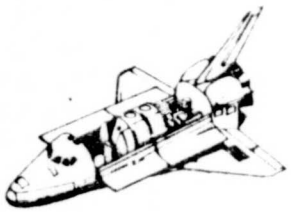
A logical evolution of the Space Construction Base (SCB) incorporates an orderly transition from the Space Transportation System (STS) and Shuttle-tended operations configuration to continuous operations configuration. Analysis of the evolutionary program indicates the elements that are needed to support it as shown in Figure 2-1.

The technology development activities using the Shuttle and Spacelab require additional power which can be supplied by a free-flying power module designed to provide the capability for construction demonstration, space processing R&D and early SPS experiments. At this point, the introduction of the Space Construction module would provide, in a Shuttle-tended mode, the first significant operational capability.

The next level of capability requires a considerable increase in on-orbit power because of the high power requirements of testing the SPS microwave power transmission system. A power platform appears to be the best way to satisfy this requirement, and it also can furnish such an abundance of power for the supporting objectives and growth options that orbital power ceases to be a limiting factor in space operations.

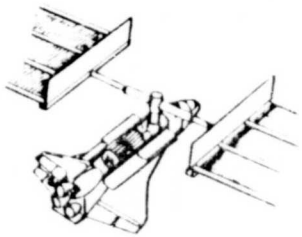
These activities may be accomplished either in a Shuttle-tended mode, or in a continuously-manned mode. The minimum cost approach would call for introduction of a continuously-manned habitability module after the technology development phase is completed but is highly dependent on the rate of planned mission buildup of activities. A slower buildup of mission activities would call for extending the Shuttle-tended mode of operation which results in funding and schedule flexibility so necessary in preliminary program planning. Figure 2-2 depicts the SCB program.

■ SHUTTLE/SPACELAB



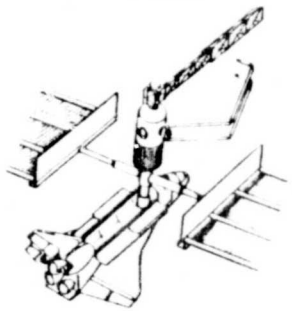
- PAYLOAD DELIVERY
- SORTIE SCIENCE MISSIONS

■ POWER MODULE



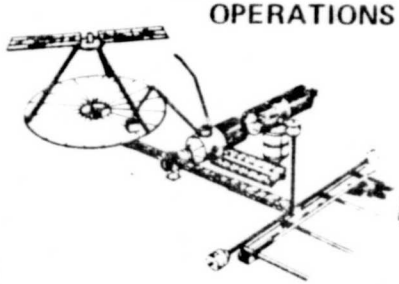
- INCREASED CAPABILITY FOR SCIENCE/ APPLICATIONS MISSIONS
- CONSTRUCTION/ FABRICATION DEMONSTRATION

■ CONSTRUCTION SYSTEM



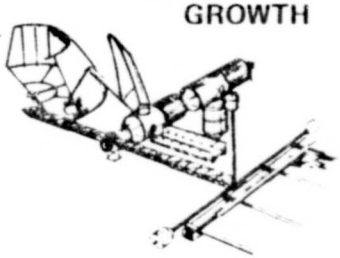
- CONSTRUCTION
- RADIOMETERS
- COMMUNICATIONS ANTENNAS
- POWER PLATFORM
- SPS ANTENNAS

■ CONTINUOUS OPERATIONS



- EXTENDED DURATION TESTS
- LONG-TERM, UNINTERRUPTED SCIENCE AND APPLICATIONS

■ MODULAR GROWTH



- SPACE PROCESSING
- SCIENCE LAB

Figure 2-1. Evolutionary Space Program

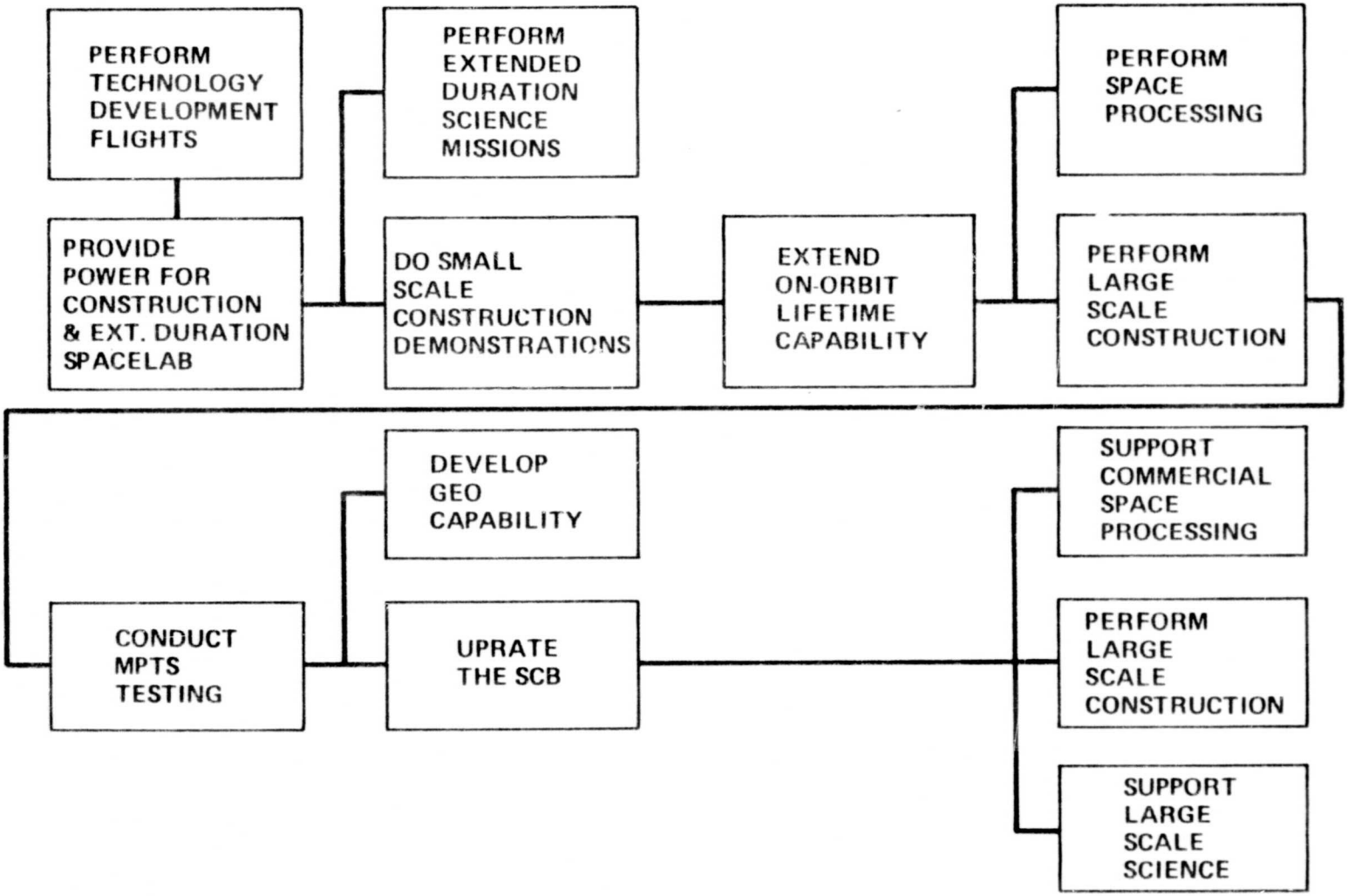


Figure 2-2. Evolutionary Program Baseline

2.2 WORK BREAKDOWN STRUCTURE (WBS)

The cost estimates for this program were divided into four major categories. (See the Work Breakdown Structure reproduced in Figure 2-3, for a detailed listing of the cost elements reported in this study.) These major categories are identified as Management and Integration, Space Construction Base, Transportation and Mission Hardware. Management and Integration includes the contractor cost associated with integrating the other three major categories of effort. The transportation costs include the cost of $19.1 million assigned to each Shuttle flight. The other two main cost categories are discussed in the following sections. Each of these categories is divided into program phases, development, production and operation as appropriate. A detailed definition of each cost element is presented in the Work Breakdown Dictionary. (See separate volume of this report.)

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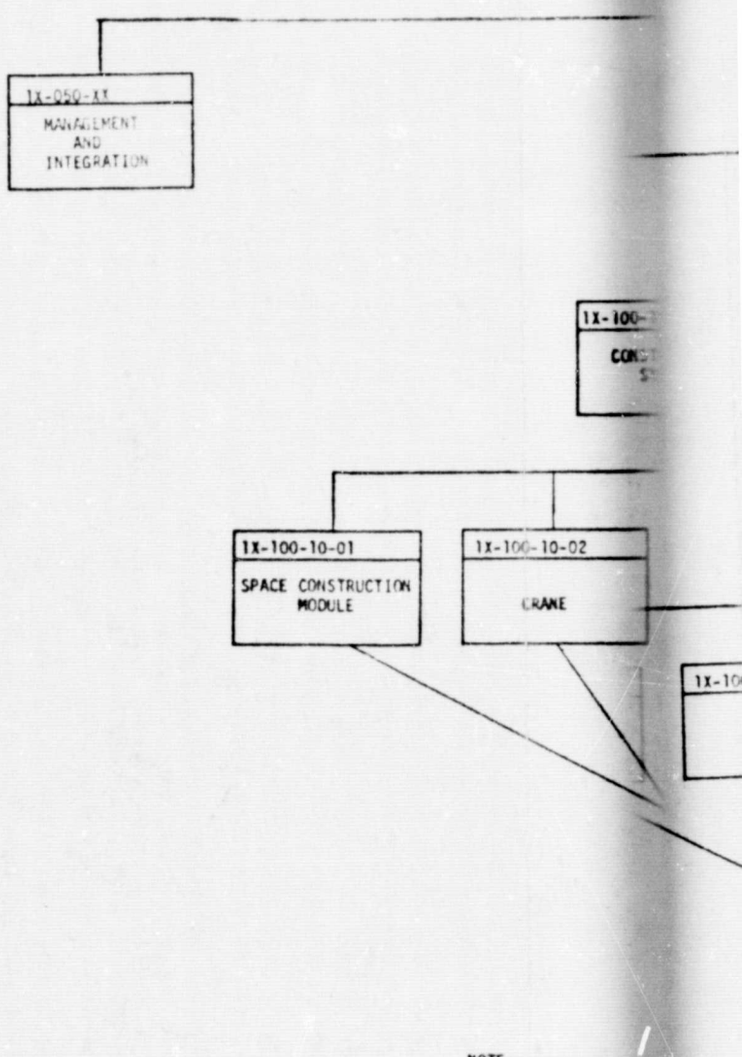

NOTE
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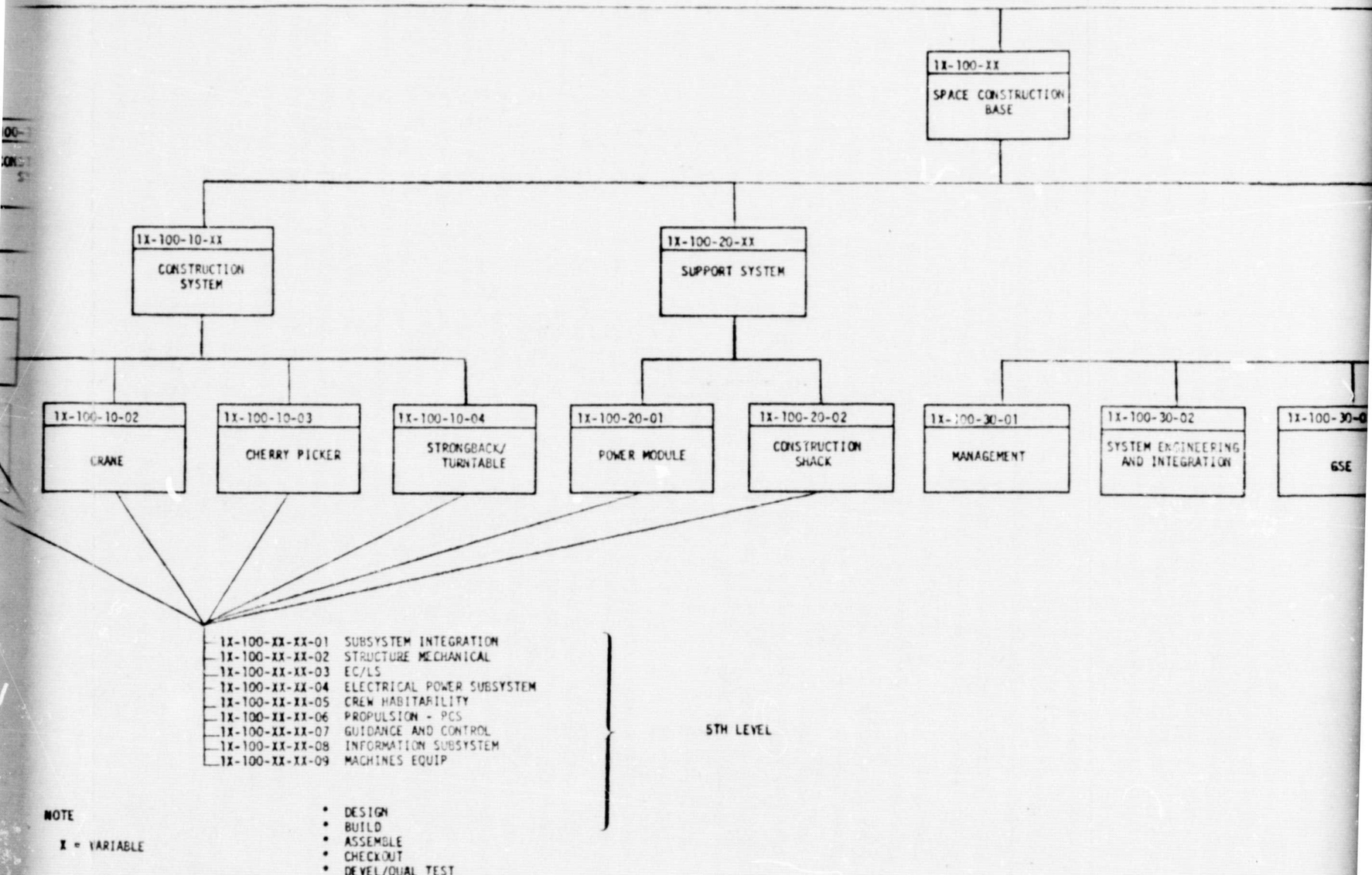
FOLDOUT FRAME 2



- 1X-100-XX-XX-01 SUBSYSTEM INTEGRATION
- 1X-100-XX-XX-02 STRUCTURE MECHANICAL
- 1X-100-XX-XX-03 EC/LS
- 1X-100-XX-XX-04 ELECTRICAL POWER SUBSYSTEM
- 1X-100-XX-XX-05 CREW HABITABILITY
- 1X-100-XX-XX-06 PROPULSION - PCS
- 1X-100-XX-XX-07 GUIDANCE AND CONTROL
- 1X-100-XX-XX-08 INFORMATION SUBSYSTEM
- 1X-100-XX-XX-09 MACHINES EQUIP

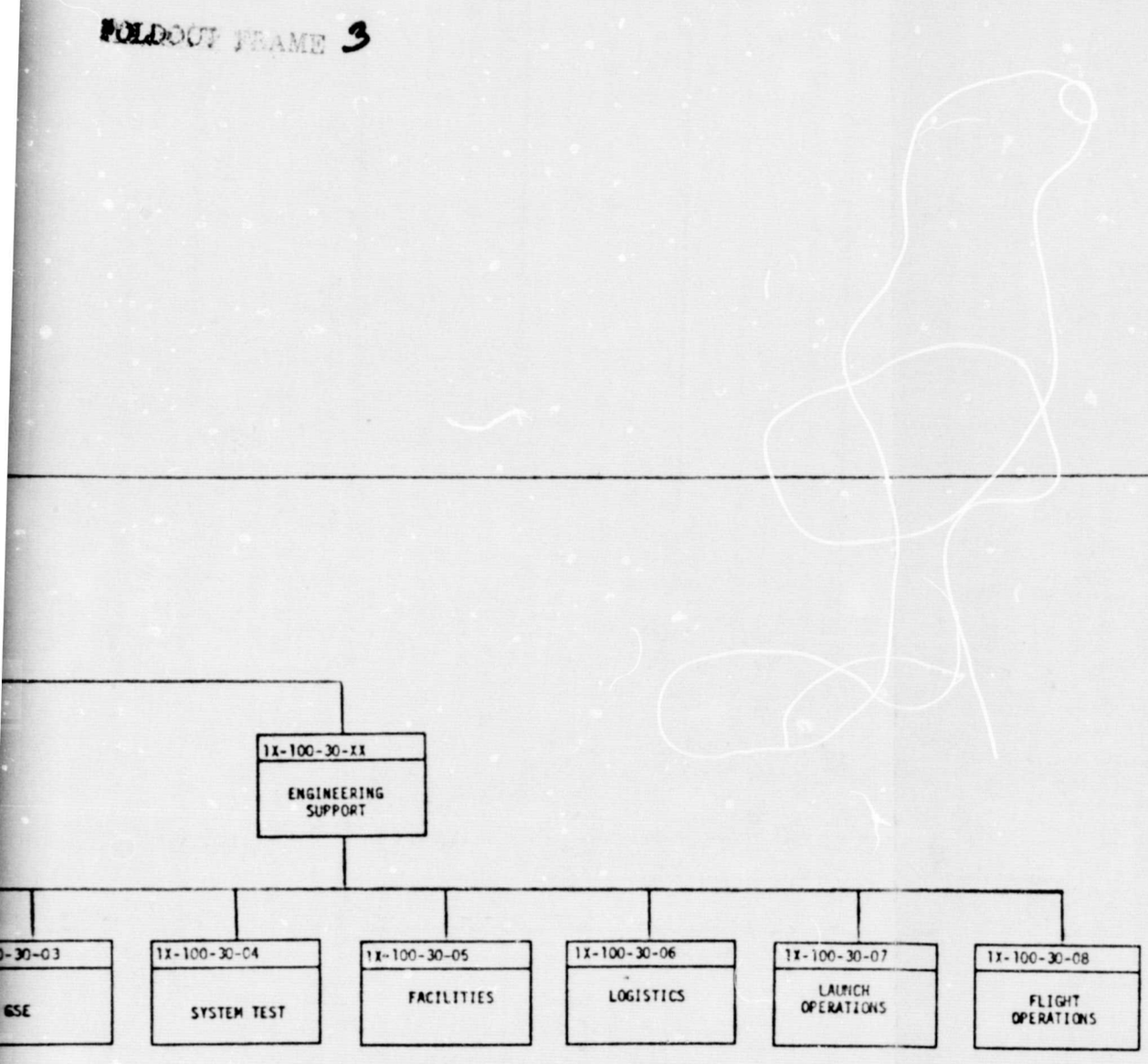
5TH LEVEL

NOTE

X = VARIABLE

- DESIGN
- BUILD
- ASSEMBLE
- CHECKOUT
- DEVEL/QUAL TEST

FOLDOUT FRAME 3



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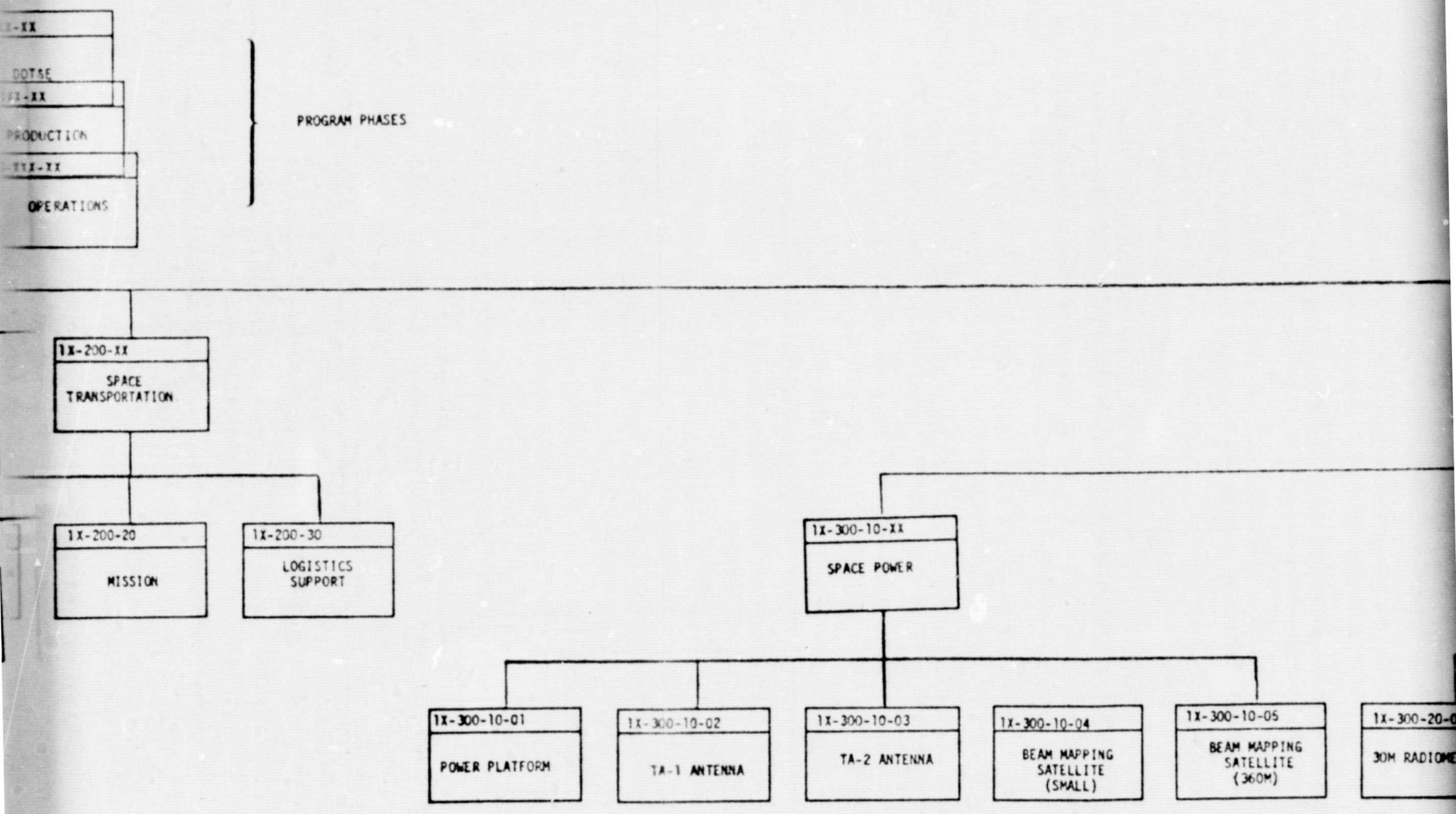


POOR QUALITY FRAME 5

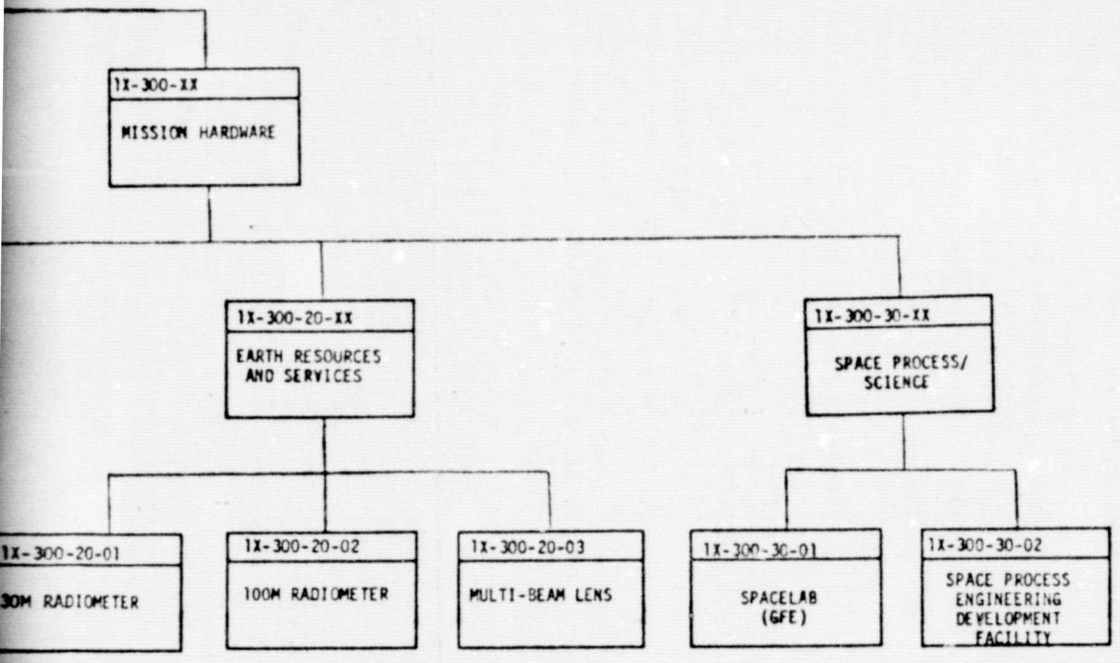


Figure 2-3. Work Breakdown

Section 3
COST GROUNDRULES AND ASSUMPTIONS

The groundrules and assumptions used for obtaining costs for Part III of the Space Station Systems Analysis Study are as follows:

1. Cost estimates are reported in constant mid-Fiscal Year (April) 1977 dollars.
2. Table 3-1 indicates the factors used to normalize previous year dollars to fiscal 1977 dollars. The foregoing data are based on "DOD deflators," Office of the Assistant Secretary of Defense (Controller), February 4, 1974; "DOD Price Escalation Indices," Defense Communications Agency Circular 600-60-1, Section F, Change 3, June 1975.
3. Funding distributions are in fiscal years beginning on October 1 and extending through September 30.
4. Cost estimates are commensurate with program definition at the time of the estimate, the relative level of the SSSAS effort, and with the understanding that the estimates are only for preliminary planning and tradeoff study purposes.

Table 3-1
DEFLATION FACTORS

Calendar Midyear	DDT&E		Production		Operations	
	% Increase	Cum	% Increase	Cum	% Increase	Cum
1969	5.5	161.8	5.2	171.3	6.5	171.9
1970	5.0	153.4	5.5	162.8	6.2	161.4
1971	3.7	146.1	4.3	154.0	7.4	152.0
1972	3.9	140.8	4.5	148.0	6.3	141.5
1973	7.5	135.6	9.8	141.6	9.5	133.1
1974	10.0	126.1	10.9	129.0	6.4	121.6
1975	9.0	114.6	10.0	116.3	9.0	114.2
1976	5.1	105.1	5.7	105.7	4.8	104.8
FY 1977		100.0		100.0		100.0

5. In general, NASA institutional and in-house costs (such as base support contractor personnel costs, civil service personnel salaries and allowances, and administrative support technical services) are not included in the program cost estimates. However, a NASA flight support and ground support cost of $60.25 million and $11 million per year respectively, are included in the operations phase of the costs. These items include some NASA costs and some contractor (probably other than hardware prime contractors) cost. The other cost elements in this study exclude all NASA in-house and all non-hardware contractor costs. (Exception item 6 below.)
6. NASA furnished Shuttle cost of $19.1 M per flight in mid-Fiscal Year 1977 dollars is used. This cost is assumed to include use of the docking/airlock module and the orbiter RCS, power, and EC/LS kits required by the shuttle-tended programs.
7. The cost estimates are developed and documented in consonance with the latest JSC approved Work Breakdown Structure (WBS) and WBS dictionary.
8. The cost estimates assume no dedicated flight test hardware.
9. All flight crew and training costs are excluded except those covered in the per flight Shuttle costs and the Launch and Flight Operations costs furnished by NASA.
10. For funding purposes it is assumed that money for the Space Construction Base will become available at the start of Fiscal Year 1980. (Program ATP is October 1, 1979.)
11. The Power Module is assumed to be authorized and have funding available one year before the principle Space Station ATP date. The module is assumed to be used by other programs prior to its launch for the Space Station. The cost of this prior use is not charged to this program. It is assumed that maintenance and any refurbishment required will be provided by the using program and completed before its launch in this program. The development and production cost of the power module and its launch for the Space Station is included in the SSSAS cost estimate.
12. For scheduling purposes it is assumed that the first Space Station Launch will be January 1, 1984.

13. Costs for this study are derived using the following criteria as a base:
    - Building block costs derived from NAR Modular Space Station Phase B module subsystem costs and subsystem reference costs are used as a base for obtaining Space Construction Base (SCB) module subsystems costs and portions of the Space Processing Engineering Development Facility (SPEDF) costs.
    - Cost Estimating Relationships (CERs), cost complexity factors, and best judgment estimates obtained in consonance with knowledgeable engineering personnel are used in obtaining the remaining costs.
14. The cost estimates reflect the engineering design emphasis on using existing hardware, especially from the orbiter. Significant cost avoidance results from assuming the only development cost for such equipment is integration and modification costs.
15. The CER's that are used are formulated from historical data stored in the MDAC Data Bank.
16. The cost of GFE equipment, including the Multi-Mission Module, Composite Fab Unit, IUS, Orbiter Docking Module, Orbiter, Orbiter kits and maintenance (except to the extend included in the $19.1 million per flight cost), Spacelab and several items of Spacelab equipment/experiments, are not included in the cost estimates but the cost, if any, of modifying GFE to meet the requirements of this program is included.
17. It is assumed that the Space Construction Module (SCM), Construction Shack (CS) and SPEDF are designed sequentially and in the order named. This approach achieves a substantial amount of cost avoidance. Portions of the CS and SPEDF that are similar to the SCM, take advantage of the previous SCM design, and therefore substantially reduce DDT&E cost.
18. The composite material complexity factor applied against the structural production CER is 4.62. Source: Kong, S.J., Dervey, A.J., and Fisher, G.H., "Application of Advanced Composites to Upper Stage Structures," NASA, February 1972.

19. The construction complexity factors applied against the structural production CER are as follows:
    - If fabricated and assembled in space, 0.15
    - If fabricated on the ground, assembled in space, 0.85
    - If fabricated and assembled on the ground, 1.00
20. A 90% (0.848) learning curve factor was applied at the component and detail level of mission hardware quantities.
21. It is assumed that any required supporting research and technology development (SRT) is completed prior to initiating the R&D phase of this program.
22. The cost of modifying the hardware (specifically Test Article 1) for GEO operation is included in the estimate. Transfer to GEO and operation at GEO is excluded from the cost estimate.

Section 4
SPACE STATION COST SUMMARY

The total cost estimate for the Space Station Program (WBS 10-000-00) defined in Part III of this study is $3,150.41 million. Of this amount, $1,456.51 million is for development (WBS 11-000-00), $903.88 million for production (WBS 12-000-00) of required hardware, and $790.02 million for operations (WBS 13-000-00) including deploying transportation. The total cost of the program is composed of $17.47 million Management and Integration (WBS 1X-050), $1,074.19 Space Construction Base (WBS 1X-100) (including $388.92 million operational cost (WBS 13-100)), $401.10 million Transportation (WBS 1X-200) and $1,657.65 Mission Hardware (WBS 1X-300). Additional detail breakdown of these figures is shown in the backup cost forms included in Section 6 of this volume and in the remainder of this section.

4.1 SPACE CONSTRUCTION BASE COSTS AND CHARACTERISTICS

The Space Construction Base consists of the hardware items placed in earth orbit which provide the capability of supporting assembly, fabrication, processing and science activities (including housing personnel participating in these activities) in space. The Construction Base is divided into two categories of items. The first category, the Construction System, contains the Space Construction Module, the Crane, the Cherry Picker Platform and the Strongback/Turntable Fixture. The second category, the Support System, contains the Power Module and the Construction Shack. See Figure 4-1.

The cost estimates for the Space Construction Base reflect extensive use of existing hardware and technology. This approach results in a significant cost avoidance in the development phase of the program. Almost all of the components used in the communication and data management systems are the same as Orbiter hardware. Some of the EC/LS components are also from the Orbiter. The solar arrays are SEPS arrays which are in an advanced stage of development.

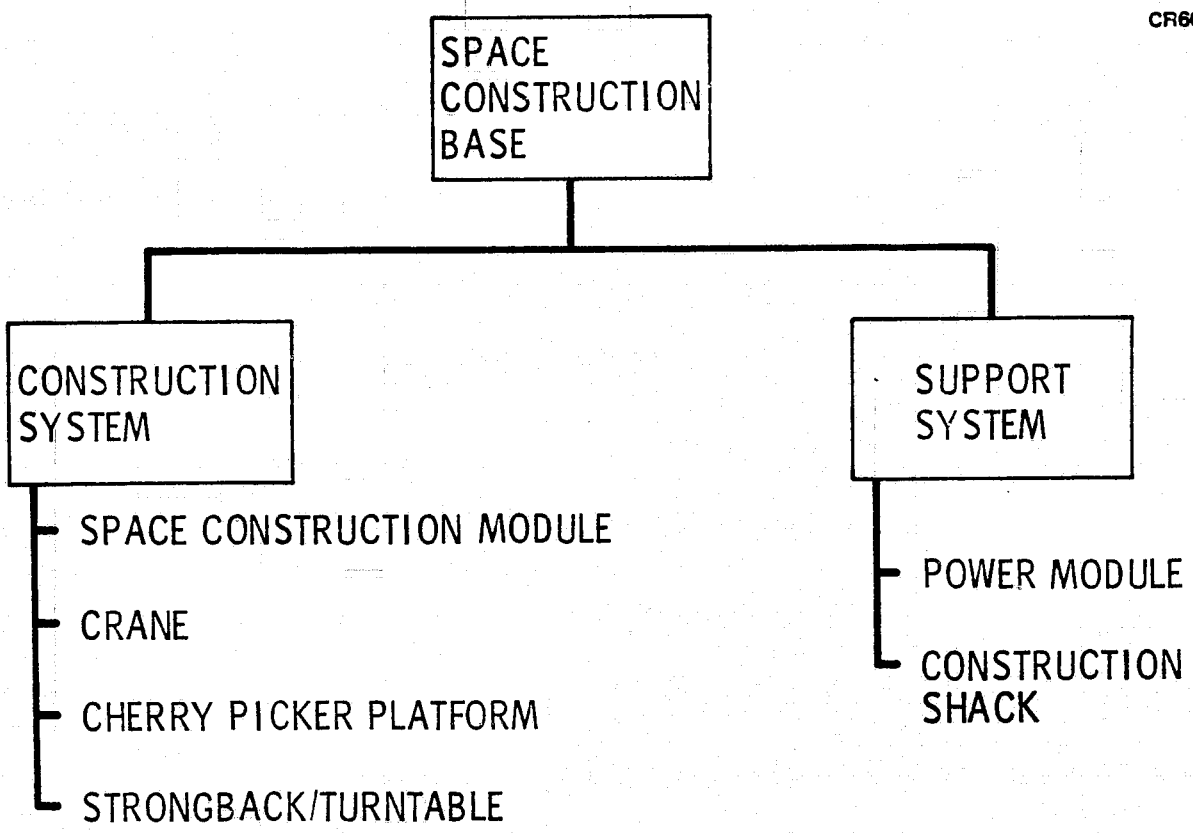


Figure 4-1. Space Construction Base

When existing hardware was used, the development cost estimates reflect only the effort required to integrate the item into the Space Construction Base. The production cost reflects the cost of producing the item.

In addition to extensive use of existing equipment, the cost estimates assumed the Composite Beam Fabrication facility, which is scheduled for development in another program, would be available to this program as GFE.

A special consideration was included for the Power Module. This unit was assumed to be built and available before it was required for this program. However, its cost was changed to this program even though it would be used by other activities prior to its incorporation in the Space Construction Base. In addition, it should be noted that some of the subsystems in the module, such as the RCS system, have been augmented beyond the minimum capabilities that would be required if the module were only supplying power to the station. These extended capabilities, though increasing the cost of the module itself, provide the additional flexibility required by the total station at minimum overall cost.

The following paragraphs present more detailed information for each of the items included in the SCB. Further design considerations and definitions are available in the technical volumes of this report.

The total Space Construction Base cost (WBS 1X-100) of $1,074.19 million is composed of $593.79 million Engineering Support (WBS 1X-100-30) which includes the base's operational cost and the balance of $480.40 million for hardware. This hardware cost is divided into $203.28 million for the Construction System (WBS 1X-100-10) and $277.02 million for the Support System (WBS 1X-100-20). (Note: A slightly different method of allocating the top level costs accounts for the minor differences between the values in this report and the values in the SRB brochure.)

4.1.1 Construction System Costs

The Construction System Costs of $203.28 million (not including its pro rata share engineering support) divided into $88.19 for the Space Construction Module (WBS 1X-100-10-01), $88.75 million for the Crane (WBS 1X-100-10-02), $10.31 for the Cherry Picker Platform (WBS 1X-100-10-03) and $16.13 for the Strongback/Turntable (WBS 1X-100-10-04). When the engineering support is added, these numbers become $123.56, $121.97, $13.89 and $21.84.

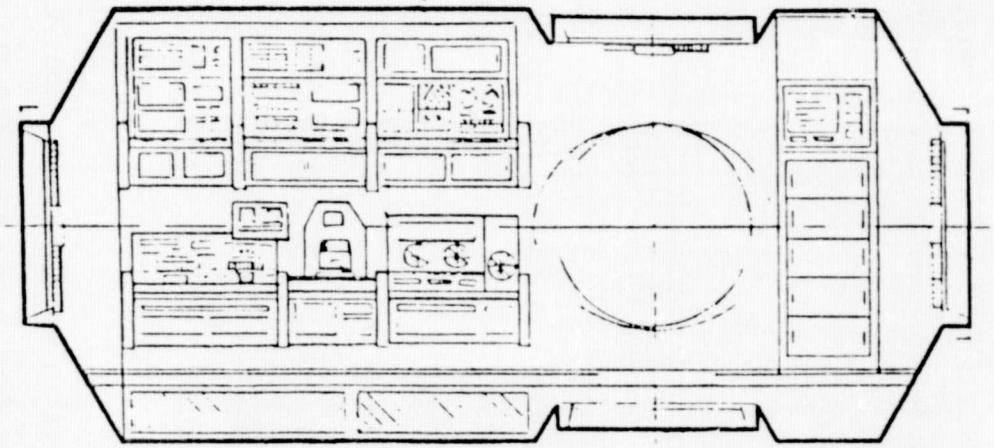
4.1.1.1 Space Construction Module (SCM)

The total program cost, selected detail costs and characteristics, and a profile view of the Space Construction Module (WBS 1X-100-10-01) are shown in Figure 4-2. Table 4-1 describes the SCM on NASA Form B.

Each of the subsystems, especially in the Information Subsystem, contain a large number of off-the-shelf assemblies, subassemblies, and components. Maximum use has been made of off-the-shelf type items from the Orbiter, as well as from other programs. This provided a significant amount of cost avoidance and achieved a large reduction in DDT&E costs since these costs reflect the advantage of utilizing previous design and development effort.

The subsystem cost for the SCM, including DDT&E and production, is $88.19 million.

The subsystem integration cost is $1.74 million.



COST:

SUBSYSTEM INTEGRATION	$ 1.74
STRUCTURAL/MECHANICAL	41.00
EC/LS	32.20
ELECTRICAL POWER	1.09
INFORMATION	12.16
SUBTOTAL	$88.19
ENGINEERING SUPPORT	35.37
TOTAL PROGRAM	$123.56

CHARACTERISTICS:

OVERALL LENGTH = 9.5 M (31.25 FEET)
TOTAL WEIGHT = 11340 KG (25,000 LB)

Figure 4-2. Space Construction Module (SCM)

Table 4-1

SPACE CONSTRUCTION MODULE

DATA FORM B

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristic	Notes
	Structure/Mechanical				
	• Primary	9.52(13.25)	m (ft)	Length	Based on Phase B MSS Core Module No. 1 DDT&E and production reference costs (RC).
	• Secondary	9.52(13.25)	m (ft)	Length	Same as for primary.
	• Shield	9.52(13.25)	m (ft)	Length	Same as for primary.
	• Berthing	6	Units		Same as for primary.
	• Crew Furnishings				Same as for primary.
	EC/LS				
	• Atmosphere Control				Based on Phase B MSS EC/LSS circulation ducts and temperature control (less 30-percent to exclude humidity control) reference costs. Phase B DDT&E and production costs are reduced due to SCM assemblies being less complex. Relating Phase B components to Orbiter components, DDT&E costs are reduced 40-percent since 60-percent of components are new or modified.
	• Thermal Control (TC)				Based on Phase B MSS EC/LSS TC reference costs. Phase B DDT&E and production costs are reduced due to SCM assembly being less complex. Relating Phase B components to Orbiter components, DDT&E costs are reduced 40-percent since 60-percent of components are new or modified. Unit production costs remain unaltered Phase B unit costs but fewer components are required.
	Electrical Power				
	• Distribution	50.8(112) $5,384	KG (pounds) $/Kg ($/lb)	Weight Cost	Production costs based on MDAC Space Station distribution costs per unit weight for this type system.
	Information				
	• Data Processing and Displays/ Controls				Based on Phase B Information Subsystem data processing and displays/controls reference costs. Relating Phase B components to Orbiter components, and applying an engineering estimate as to the number of Orbiter components used.
	• Communications				Based on data processing and displays/control logic. DDT&E production costs were significantly reduced because existing Orbiter hardware and fewer units.

The Structural/Mechanical Subsystem (S/MS) manufacturing cost is $41.00 million. This cost was obtained from the Phase B MSS Core Module No. 1 (C No. 1) Structure Subsystem costs. Since this module is the first one of this size developed for this program, it carries the full development and first unit production cost.

The Environmental Control and Life Support Subsystem (EC/LSS) cost is $32.20 million. Both the atmosphere control and thermal control assemblies are based on Phase B MSS EC/LSS costs and recognize prior development of any items used in the Orbiter. The circulation ducts, temperature control, and fans development costs are reduced substantially, since some of their design is already accomplished for the Orbiter. The production cost was decreased from that of the reference because not as many units are required. The same logic applies to the thermal control assembly costs.

The Electrical Power Subsystem (EPS) cost is $1.09 million. Only a distribution system for power is required and the costs are based on a cost per weight factor. This factor is obtained from historical data and is applied to engineer supplied weights.

The Information Subsystem (IS) cost is $12.16 million. These costs are derived from the Phase B MSS Information Subsystem costs. Relating the subsystem components to the Orbiter, most of the data processing, displays/controls, and communications hardware will be off-the-shelf type components. This fact permits large cost avoidance in the DDT&E costs since most of the design and development effort has been accomplished. Also, only a small amount of the hardware items will be used, which significantly reduces the production costs.

The engineering support cost of $35.37 million added to the total subsystem cost sums to the total program cost of $123.56 million for the SCM.

4.1.1.2 Crane and Cherry Picker Platform

The total program cost, selected detail costs and characteristics and an action view of the crane and cherry picker platform (WBS 1X-100-10-02)

are shown in Figure 4-3. The costs for development and production of the crane assume the use of the Shuttle RMS technology and that the additional cost for the crane will be equal to the original cost of the RMS. Compared to the RMS, the reach is longer by 2.5 to 1, it has two arms rather than one and is turret mounted to a Space Construction Module berthing port. The cylindrical portion of the turret is made of aluminum and the arms are made of epoxy. The crane software is similar to the RMS software. It also consists of meteoroid shield, dome, console, lighting, and subsystem interfaces.

The hardware manufacturing cost for the crane is $88.75 million.

Adding the engineering support cost of $33.22 million provides the total program cost of $121.97 million for the crane.

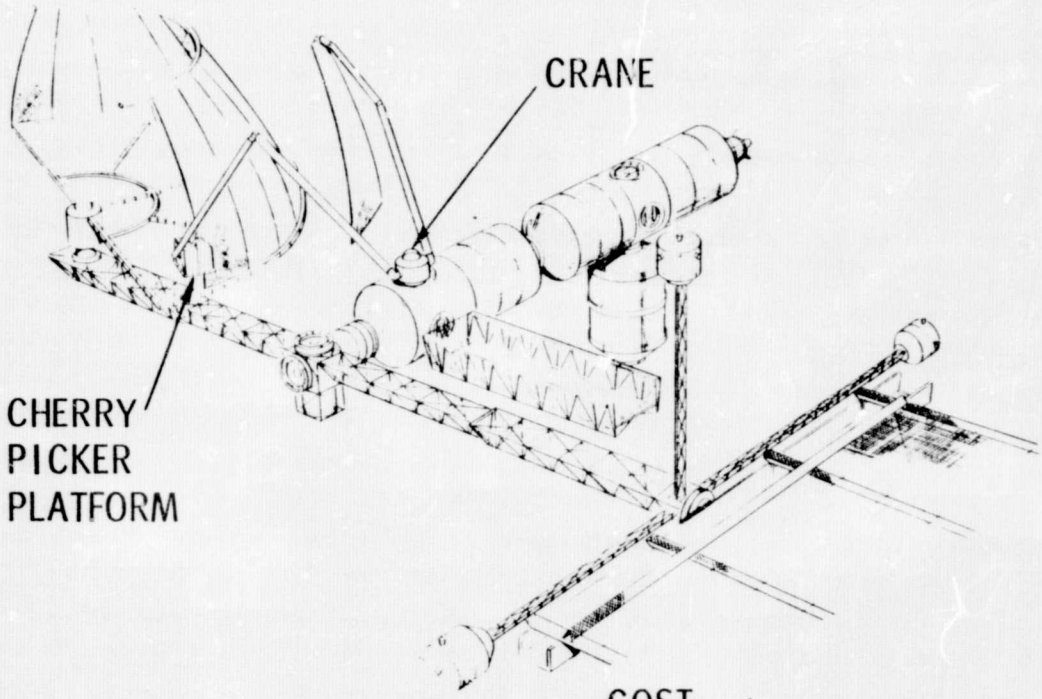
The Cherry Picker hardware manufacturing cost is $10.31 million. This is an estimate based on the Shuttle Orbiter RMS. Compared to the RMS, the Cherry Picker is less complex by a factor of 0.125. This factor is applied to both the RMS DDT&E and production costs to obtain the Cherry Picker costs. Basically, the Cherry Picker consists of an alternate control station, EVA backpacks, electrical lines only, and floodlights.

Adding the engineering support costs of $3.58 million to the manufacturing costs provides the total program cost of $13.89 million for the Cherry Picker Platform.

4.1.1.3 Strongback/Turntable

The total program cost, selected detail costs and characteristics, and action profile for the strongback/turntable (WBS 1X-100-10-04) are shown in Figure 4-4. Table 4-2 describes the strongback/turntable on NASA Form B.

The costing approach for the strongback/turntable is based on an orbital construction concept definition of fabricating and assembling the components on the ground.



COST:	
CHERRY PICKER	$10.31
ENGINEERING SUPPORT	3.58
TOTAL PROGRAM	$13.89

CHARACTERISTICS:

TOTAL WEIGHT = 150 KG (331 LB)

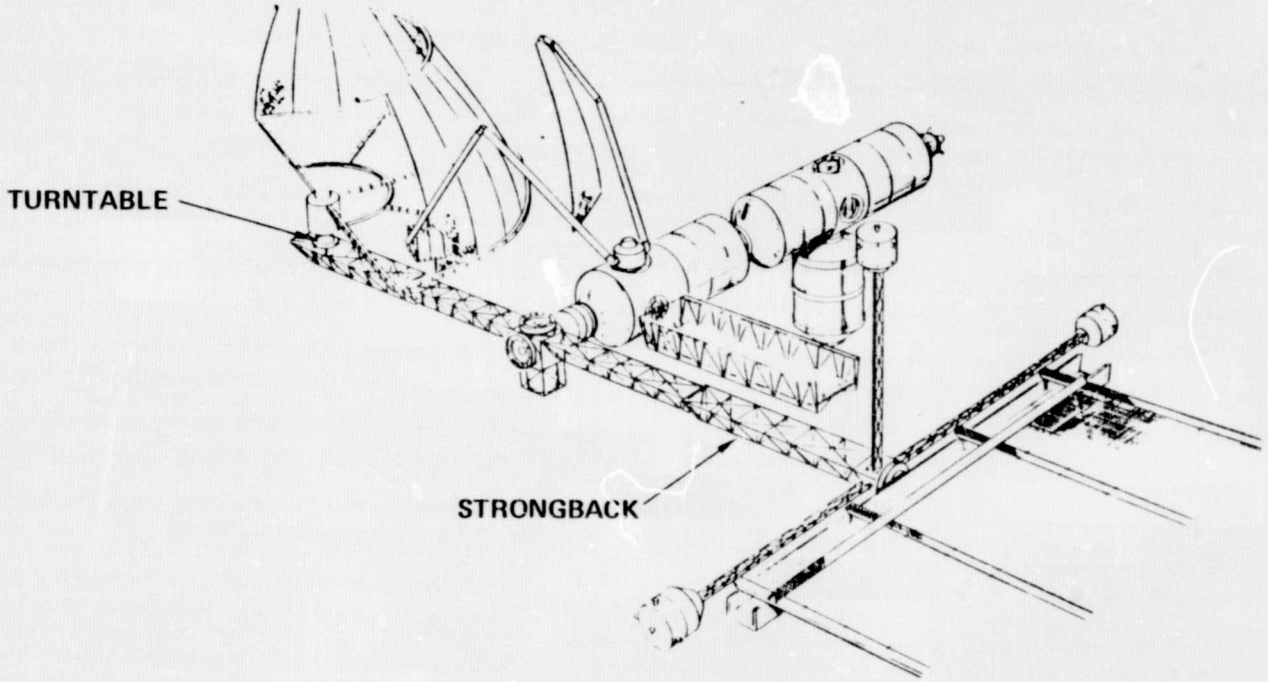
COST:	
CRANE	$ 88.75
ENGINEERING SUPPORT	33.22
TOTAL PROGRAM	$121.97

CHARACTERISITCS:

TOTAL WEIGHT = 1590 KG (3505 LB)

Figure 4-3. Crane and Cherry Picker Platform

CR60



COST:

STRONGBACK	$ 12.60
TURNTABLE	3.53
SUBTOTAL	$ 16.13
ENGINEERING SUPPORT	5.71
TOTAL PROGRAM	$ 21.84

CHARACTERISTICS:

	STRONGBACK	TURNTABLE
TOTAL WEIGHT	1940 KG (4277 LB)	230 KG (507 LB)
DIMENSIONS		
LENGTH	40 M (131 FT)	
WIDTH	3 M (10 FT)	
HEIGHT	2 M (7 FT)	0.6 M (2.0 FT)
DIAMETER		2.2 M (7.2 FT)

Figure 4-4. Strongback/Turntable

MCDONNELL DOUGLAS

Table 4-2
STRONGBACK/TURNTABLE
DATA FORM B

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Strongback				
	Structure/Mechanical				
	Beam	1,400(3,086)	kg (lb)	wt	SIV-B simple adapter CERs
	Berthing Ports	399(880)	kg (lb)	wt	DDT&E engineering judgment Prod-SIV-B simple adapter CER, quantity = 4
	Tunnel	141(311)	kg (lb)	wt	SIV-B simple adapter CERs
	Indexing Turntable				
	Structure/Mechanical	230(507)	kg (lb)	wt	SIV-B simple adapter CERs

The hardware manufacturing cost including DDT&E and production for the strongback is $12.60 million. The strongback is composed of the following components: beam assembly, 4-berthing ports and tunnel. All of the components are made out of aluminum and SIV-B simple adapter CER's are used to calculate the DDT&E and production costs.

The hardware manufacturing cost for the turntable is $3.53 million. SIV-B simple adapter CER's are used to calculate the DDT&E and production costs for the aluminum structure.

The sum of the strongback and turntable costs is $16.13 million.

Adding the engineering support cost of $5.71 million provides the total program cost of $21.84 million for the strongback/turntable.

4.1.2 Support System Costs

The $277.02 million of the Support System hardware is divided into $114.78 million for the Power Module (WBS 1X-100-20-01) and $162.24 million for the Construction Shack (WBS 1X-100-20-02).

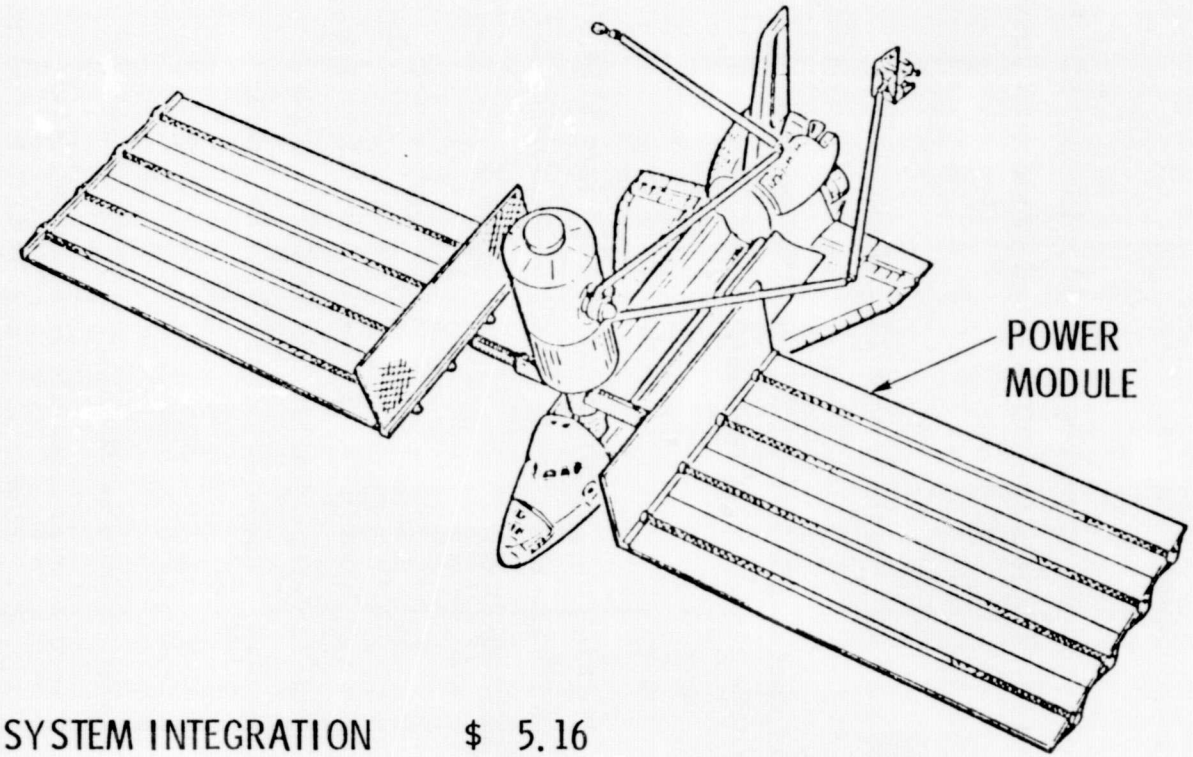
4.1.2.1 Power Module

The total program costs of the Power Module (WBS 1X-100-20-01) with a breakdown by subsystems, the total system weight and the SEPS array blanket area are shown in Figure 4-5. Table 4-3 describes the Power Module on NASA Form B.

The costing approach for the power module is based on MDAC, Phase B electrical power costs and Lockheed's Solar Electric Propulsion System (SEPS) electrical power costs. All other costs are based on SIV-B structural CER's and unmanned spacecraft CERs.

The subsystem integration cost is $5.16 million.

The cost including DDT&E and production for the Structure/Mechanical subsystem is $16.05 million. The structure/mechanical subsystem is composed of a central or core module with a berthing port and two telescoping masts,



COST:

SUBSYSTEM INTEGRATION	$ 5.16
STRUCTURAL/MECHANICAL	16.05
EC/LS	3.00
ELECTRICAL POWER	59.52
FREE FLIGHT SUPPORT	31.05
SUBTOTAL	$114.78
ENGINEERING SUPPORT	57.52
TOTAL PROGRAM	$172.30

CHARACTERISTICS:

WEIGHT	
TOTAL	12,261 KG (27,031 LB)
ARRAY	3,245 KG (7,154 LB)
AREA-ARRAY	1,000 M^2 (10,764 FT^2)

Figure 4-5. Power Module

Table 4-3 (Page 1 of 2)
POWER MODULE
DATA FORM B

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Subsystem Integration				10% of production base cost
	Structure/Mechanical				
	Module	144(317)	kg (lb)	wt	S-IVB machined waffle CERs
	4 Ft Dia Mast	411(906)	kg (lb)	wt	S-IVB simple adapter CERs – quantity = 2
	3 Ft Dia Mast	231(510)	kg (lb)	wt	Same as 4 ft dia mast
	2 Axis Gimbal	1,250(2,756)	kg (lb)	wt	S-IVB simple adapter CERs – quantity = 2
	Berthing Port	200(440)	kg (lb)	wt	DDT&E – engineering judgment Prod – S-IVB simple adapter – quantity = 2
	EC/LS	159(350)	kg (lb)	wt	U/M S/C inver ctl CERs
	Electrical Power				
	Battery				
	DDT&E	40	kg	Power Rating (BOL)	Based on MDAC Phase B costs – DDT&E adj by kw rating raised to 0.5 power
	Prod	76		No. of Cells per Battery	Prod adj by No. of cells; 90% learning curve applied to 16 batteries
	Chargers	40	kw	Power Rating (BOL)	Based on MDAC Phase B costs – DDT&E adj by kw rating raised to 0.5 power Prod adj by kw rating
	Regulators	40	kw	Power Rating (BOL)	Same as Chargers
	Inverters	40	kw	Power Rating (BOL)	Same as Chargers
	Switches, Wiring, Cabling	40	kw	Power Rating (BOL)	Same as Chargers
	Solar Arrays - DDT&E				Based on Lockheed SEPs cost
	Blanket - Prod	1,000(10,764)	m^2 (ft^2)	Area	Based on Lockheed SEPs cost – adj by array area and quantity
	Mast - Prod				Based on Lockheed SEPs cost – adj by quantity with a 90 learning curve

Table 4-3 (Page 2 of 2)
POWER MODULE
DATA FORM B

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Container - Prod				Same as Solar Array - Mast
	Drive Assy - Prod				Same as Solar Array - Mast
	Electronics - Prod				Based on Lockheed SEPs cost — adj by quantity
	Radiators	343(756)	kg (lb)	wt	S-IVB simple adapter CERs — prod — quantity = 8
	Free Flight Supt Sys				
	Guidance and Control	59(130)	kg (lb)	wt	U/M S/C G&N CERs
	RCS	227(500)	kg (lb)	wt	U/M S/C attitude control CERs
	Information	59(131)	kg (lb)	wt	U/M S/C TTC CERs

each with a Z-axis gimbal, that connect to the SEPs solar arrays. The core module is assumed to be standard design with SIV-B machine waffle CERs used to calculate the DDT&E and production costs. The berthing port is also a standard design and SIV-B simple adapter CER is used to calculate the production cost. The DDT&E cost was estimated to be very small since many berthing ports are utilized in this study. The telescoping masts and Z-axis gimbals both use SIV-B simple adapter CERs to calculate the DDT&E and production costs.

The EC/LS subsystem cost is $3.00 million. The EC/LS subsystem is composed of active and passive systems with the unmanned spacecraft environmental control CERs being used to calculate the DDT&E and production costs.

The cost of the Electrical Power subsystem is $59.52 million. The electrical power subsystem is composed of a battery system and the SEPs solar array system. The battery system contains the following items: batteries, battery chargers, battery regulators, battery inverters and switches, wiring and cabling. The DDT&E and production costs for these items are calculated by using a ratio of the kw rating and number of cells per battery based on MDAC, Phase B costs.

The SEPs solar array system was composed of the blanket, mast, container, drive assembly, electronics and radiators. The DDT&E and production costs of these components are calculated by using a ratio of quantities required based on the Lockheed SEPs array costs.

The hardware manufacturing cost for the Free Flight Support System is $31.05 million. The free flight support system for the power module is composed of three subsystems: guidance and control, propulsion/RCS and information (telemetry). All three subsystems use the unmanned spacecraft CERs to calculate the DDT&E and production costs.

The sum of all the subsystem costs including subsystem integration is $114.78 million. Adding the engineering support cost of $57.52 million provides the total program cost of $172.30 million for the power module.

4.1.2.2 Construction Shack

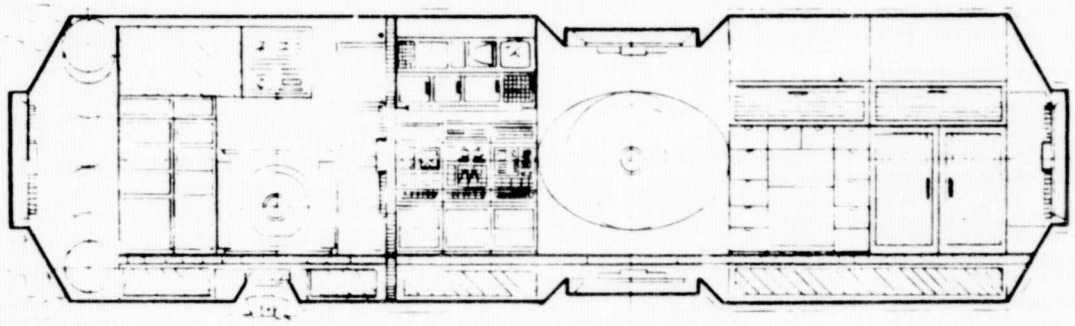
The total program cost, subsystems costs, and profile view of the Construction Shack (CS) (WBS 1X-100-20-02) are shown in Figure 4-6. Table 4-4 describes the CS on NASA Form B.

Each of the subsystems, especially in the Information and Communications Subsystem, contain a larger number of off-the-shelf type assemblies, subassemblies, and components. Maximum use has been made of off-the-shelf type items from the Orbiter, as well as from other programs. This permits a large reduction in DDT&E costs since these costs reflect the advantage of considering previous design and development effort.

The total subsystem cost for the CS, including both DDT&E and production is $162.24 million.

The Structural/Mechanical subsystem cost is $22.10 million. These costs were calculated using the SCM costs as a base. Since the CS and CSM subsystems are very similar, the CS DDT&E costs reflect a substantial cost avoidance. The CS production costs for the primary and secondary structure, shield, and crew furnishings were calculated by increasing the SCM production costs by a ratio using a length as a parameter. The CS berthing production costs are unaltered SCM costs. CS airlock costs are obtained using airlock costs derived during Part II of this study. Part II costs were reduced to account for the smaller and less complex CS airlock.

The total EC/LSS subsystem cost is $50.80 million. The EC/LSS costs are derived from several sources. The atmosphere storage, CO_2 management and water management DDT&E and production costs were obtained from an engineering EC/LSS trade study which applies directly to the CS. The remaining costs are based on EC/LSS reference costs. The atmosphere control and thermal control assemblies are similar to the SCM assemblies. Obviously, very little DDT&E effort is needed for the CS assemblies, and therefore CS DDT&E costs are greatly reduced CSM DDT&E costs. It is assumed that CS production costs are the same as SCM production costs. Waste Management Subsystem DDT&E costs are approximately 50-percent of the Waste Management Subsystem reference costs to reflect use of existing



COST:

SUBSYSTEM INTEGRATION	$ 5.98
STRUCTURAL/MECHANICAL	22.10
ECLS	50.80
ELECTRICAL POWER	1.09
CREW SUPPORT	7.05
GUIDANCE & NAVIGATION	25.39
INFORMATION	49.83
SUBTOTAL	$162.64
ENGINEERING SUPPORT	78.39
TOTAL PROGRAM	$240.63

CHARACTERISTICS:

OVERALL LENGTH = 16.15 M (53 FEET)

TOTAL WEIGHT = 9525 KG (21,000 LB)

Figure 4-6. Construction Shack (CS)

Table 4-4 (Page 1 of 3)
CONSTRUCTION SHACK
DATA FORM B

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristic	Notes
	Construction Shack (CS) Structure				
	• Primary	16.2(53)	m (ft)	Length	Based on CSM DDT&E and production costs. DDT&E costs are greatly reduced to take advantage of previous CSM design effort. Production costs are increased to account for greater length of CS.
	• Secondary	16.2(53)	m (ft)	Length	Same logic as for primary.
	• Shield	16.2(53)	m (ft)	Length	Same logic as for primary.
	• Berthing	6	Units		DDT&E costs based on same logic as for primary. Production costs are unaltered CSM production costs.
	• Crew Furnishings				Same logic as for primary.
	• Airlock				Based on Part 2 airlock costs. DDT&E costs adjusted for previous design impact. DDT&E and production costs adjusted for smaller size of CS airlock.
	EC/LS				
	• Atmosphere Storage	15	Tanks		Based on DDT&E and production costs obtained from EC/LS trade study.
	• CO_2 Management				Same logic as for atmosphere storage.
	• Atmosphere Control				DDT&E costs for ducts and temperature control are reduced SCM costs due to similar design. Production costs for these items remain the same as SCM costs.
		1	set	7 man	Pressure control costs are based on Phase B MSS EC/LSS pressure control costs. Phase B DDT&E and production costs are reduced due to CS assembly being less complex. Relating Phase B components to Orbiter components, DDT&E costs are reduced to reflect only 60-percent of assembly is new or modified.
	• Thermal Control	1	set		Based on SCM costs. Both the DDT&E and production costs are reduced due to previous SCM design.
	• Water Management	1	set		Same logic as for atmosphere storage.

Table 4-4 (Page 2 of 3)
CONSTRUCTION SHACK
DATA FORM B

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristic	Notes
	• Waste Management	1	set		Based on Phase B MSS EC/LSS Waste Management costs. Phase B DDT&E costs are reduced since the CS assembly is less complex. Production costs are unaltered Phase B production costs.
	• Special Life Support	1	set.		Based on Phase B MSS Special Life Support EVA/IVA provisions and fire control costs. Phase B DDT&E costs are reduced to reflect only 60-percent is new or modified. EVA/IVA provisions production costs are unaltered Phase B production costs. Fire control production costs are increased Phase B fire control production costs since the CS assembly is more complex.
	Electrical Power				
	• Distribution	50.8(112) $5,384 ($1,500)	kg (pound) $/kg ($/lb)	Weight	Production costs based on MDAC Space Station distribution costs per unit weight for this type system.
	Information				
	• Data Processing and Displays/Controls	1	set	(See technical description)	Same logic as for SCM data processing and displays/controls except that costs were reduced 65-percent.
	• Communications				Same logic as for SCM data processing and displays/controls except that costs were reduced 50-percent.
	Guidance and Navigation				
	• Optical Reference Assy	1	set	(See technical description)	Based on Phase B MSS G&NS optical reference costs. CS requires all components except the alignment links and sextant/telescope. Phase B DDT&E costs are reduced due to previous Orbiter design effort. Production costs are unaltered. Gimbal costs furnished by engineering.
	• Inertial Reference Assy	1	set	(See technical description)	Based on Phase B MSS G&NS inertial reference assembly reference costs. Phase B DDT&E costs are reduced due to previous Orbiter design effort. Production costs are unaltered Phase B production costs.

Table 4-4 (Page 3 of 3)
CONSTRUCTION SHACK
DATA FORM B

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	• RCS Electronics Assembly	1	set	(See technical description)	Based on Phase B MSS G&NS RCS electronic assembly reference costs. Phase B DDT&E costs are reduced due to previous Orbiter design effort. Production costs are unaltered Phase B production costs.
	• Software				Based on Phase B MSS G&NS software reference costs. CS DDT&E and production costs are ratioed from Phase B DDT&E and production costs.
	Crew Support				
	• Food Management	1	set	7 man capability	Based on Phase B MSS crew support food management reference costs. CS DDT&E and production costs are reduced Phase B DDT&E and production due to less complexity of CS assembly.
	• Hygiene				Based on Phase B MSS crew support hygiene reference costs. CS DDT&E costs are reduced Phase B DDT&E costs due to previous design effort. CS production costs are unaltered Phase B production costs.
	• Furnishings				Based on Phase B MSS SM-1 costs. DDT&E costs are reduced due to previous design. Production costs are doubled since more furnishings are required.
	• Recreation, Exercise, Crew Care				Same logic as for furnishings except that production costs are unaltered.
	• General/Emergency Provisions				Same logic as for furnishings except that production costs are also reduced since fewer provisions are required.

Orbiter hardware and relaxed design requirements for new and modified items. Production costs are derived from production reference costs. Special Life Support requires IVA/EVA provisions and fire control. The DDT&E costs for the IVA/EVA provisions reflect the engineering definition that about 40-percent existing or modified Orbiter equipment is used on this system. The fire control DDT&E costs reflect an assembly that is more complex. The IVA/EVA provisions production costs utilize the production reference costs but the fire control production costs are greater than the reference costs to reflect the additional complexity.

The EPS subsystem cost is $1.09 million. The criteria pertinent to the CMS EPS applies directly to the CS EPS.

The total Information Subsystem cost is $49.83 million. Like the CSM, these costs are based on the Information Subsystem reference costs. The CS costs are greater than the CSM costs since more hardware is required for the CS data processing, displays/controls, and communications assemblies. The requirement for more hardware increases the DDT&E cost and production costs. However, the data processing and displays/controls DDT&E reference costs has been reduced to reflect the utilization of 65-percent existing hardware and communications the 50-percent existing hardware.

A total Guidance and Navigation Subsystem (G&NS) cost is $25.39 million. The G&NS is located on the CS but the Reaction Control Subsystem (RCS) is located on booms remote from the CS. The G&NS is composed of the optical reference, inertial reference, and RCS electronics assemblies and the software required for these assemblies. The costs are based on G&NS reference costs. Many of the items are off-the-shelf Orbiter components which reduces the DDT&E cost significantly. Several components shown in the reference costs are not required which reduces both the DDT&E and production costs.

The total Crew Habitability Subsystem (CHS) cost is $7.05 million. These costs are obtained from several sources. The CHS is a very austere subsystem. For example: sponge baths replace showers; food will be of the easily prepared and freeze dried types; and great amounts of personal items

will not have to be stored for great lengths of time due to frequent shuttle orbiter visits. For food management the oven and reconstituion unit are the most significant item. In the hygiene assembly the number of items are greatly reduced, such as the requirements for sinks and housekeeping items. Furnishings are very austere. Food management and hygiene costs are reduced Phase B MSS Crew Habitability assembly costs. The remaining costs are reduced Phase B MSS SM-1 costs. These costs are obtained according to engineering estimates.

Adding the engineering support cost of $78.39 million to the subsystems costs provides the total program cost of $240.63 for the Construction Shack.

4.2 MISSION HARDWARE

The Mission Hardware portion of this study consists of the hardware items and special tooling used to complete a set of space objectives. In Part III of the study, these objectives, and the Mission Hardware, are divided into three major groups. These groups are the Space Power Systems, the Earth Services items and the Space Processing and Science items. Figure 4-7 shows these groups and the specific projects that are included in each of the three groups.

Each of the projects contains not only the end product itself; such as the TA-1 antenna, but also the special in-space tooling and equipment required by the project. Specifically, this includes such items as the 1 meter composite beam fabrication machine required with the Power Platform, the special pallet-fixture required with the TA-1 antenna and the strongback extension required with the 100 meter radiometer. When special tooling is used for more than one project, it is charged to the first usage. The detail cost printout (see Section 6) lists the tooling for each project and shows zero cost if the tooling is available from another project or is GFE.

In addition to the end product and special tooling, the cost of each project includes the hardware that permits the item to be an autonomous free flyer — if it exists in such a configuration. Table 4-4A indicates which mission hardware has free flight capability. For purposes of this study, these free flight support systems were one of two types depending on the accuracy of the orientation and control system.

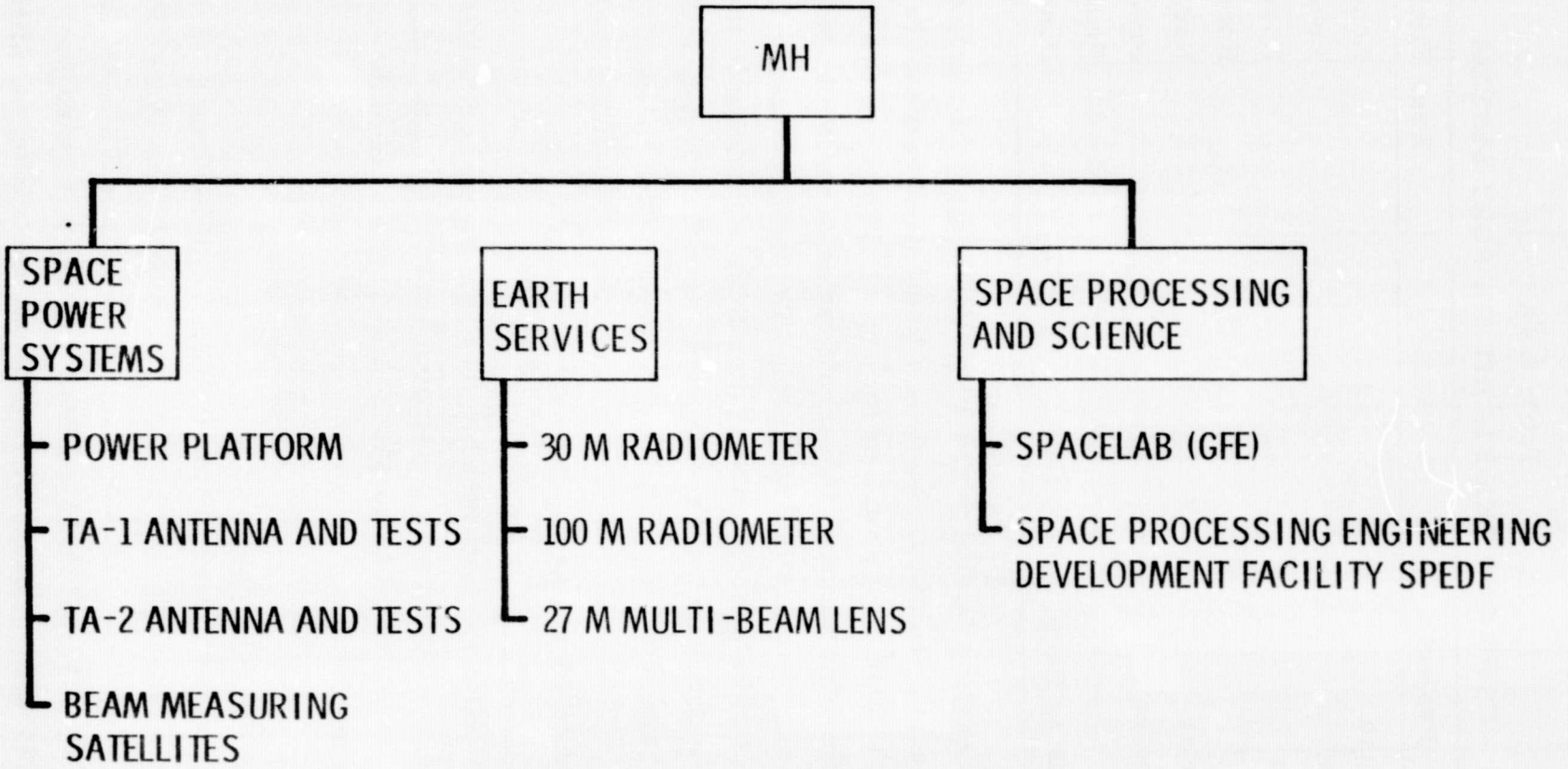


Figure 4-7. Mission Hardware

Table 4-4A

TYPE OF FREE FLIGHT SUPPORT SYSTEM

Project	Free Flight Capability
Power Platform	None
TA-1 Antenna	Precision
TA-2 Antenna	None
BMS	Normal
30M Radiometer	Normal
100M Radiometer	Precision
27M MBL	Precision
Space Processing Development Lab	None

The Beam Measuring Satellites are a unique category of mission hardware. These are special, free flying hardware items used to measure the intensity of the fields radiated by the various antennas. There are two satellites used in the program. One satellite is a modification of the Multi-Mission Module hardware developed in another program. The basic hardware is assumed to be GFE but the costs associated with modifying and adding to the equipment to meet the requirements of this program, a total of $18.49 million is included in the costs charged to this program. This satellite, the BMS-QC (small) is used with the TA-1, and TA-2 antennas, the 30M and 100M radiometer, and the 27M Multi-Beam Lens.

The second satellite was estimated to be based on the Multi-Mission Module technology and is a larger unit constructed in space. This unit, whose total program cost is estimated to be $93.17 million is used only with the TA-1 and TA-2 antennas.

4.2.1 Space Power Systems

The cost of the Space Power Systems (WBS 1X-300-10) is $695.00 million. It is composed of five mission hardware elements: the Power Platform project (WBS 1X-300-10-01) is $165.56 million, the TA-1 Antenna project (WBS 1X-300-10-02) is $285.77 million, the TA-2 Antenna project (WBS 1X-300-10-03) is $132.01 million, the Small Beam Mapping Satellite (WBS 1X-300-10-04) is $18.49 million for the modification of the Multi-Mission Module

(GFE) and the 360 meter Beam Measuring Satellite (WBS 1X-300-10-05) is $93.17 million. Each of these costs include development and production of the hardware, the first use tooling and the engineering support. Any special tooling that is used for more than one project is charges to the project that uses it first. The detail cost printouts in Section 6 list all the special tooling required for each mission hardware project but show costs only for the first usage.

4.2.1.1 Power Platform and RCS Package

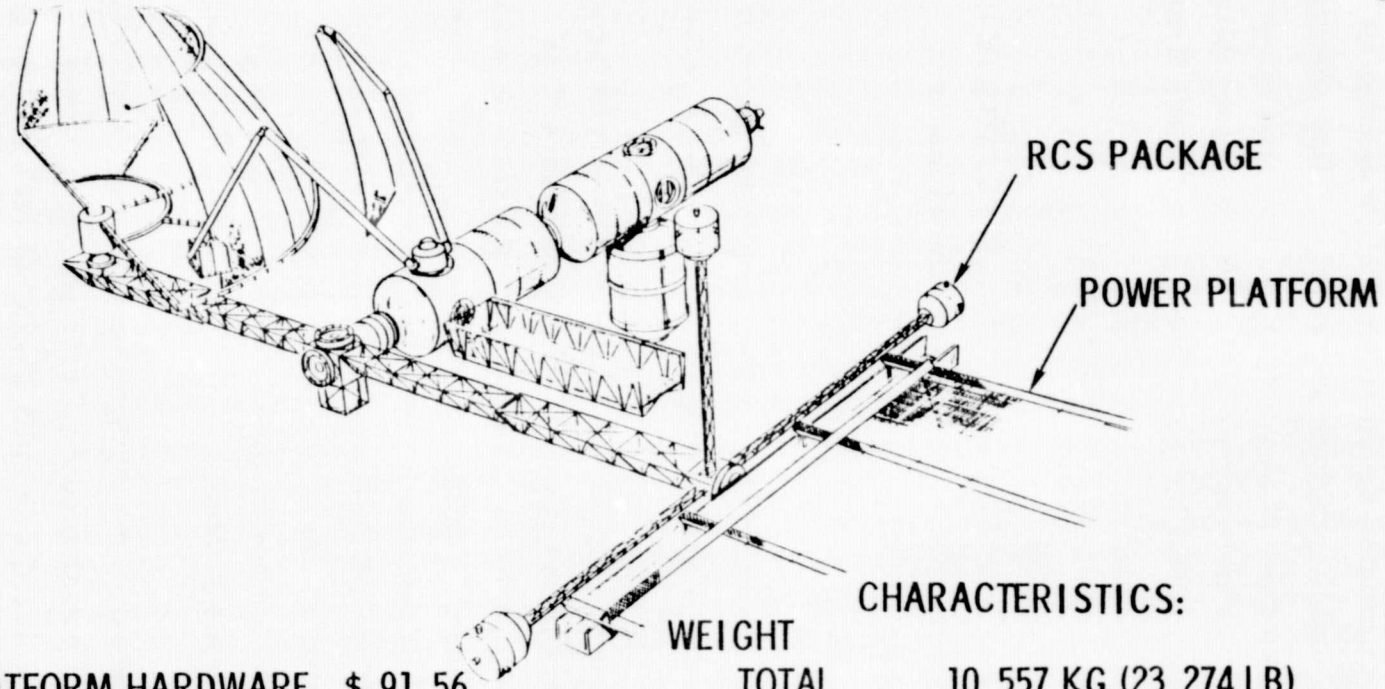
The total program cost for the Power Platform and RCS Package (WBS 1X-300-10-01) with a breakdown by components, total system and component weights, dimensions and area is shown in Figure 4-8. Table 4-5 describes the power platform on NASA Form B.

The costing approach for the power platform is based on an orbital construction concept definition of fabricating and assembling the components in space.

The assembly fixture not only aligns the longerons while the power platform is being made but also becomes part of the power platform structure once the construction of the platform is completed. The assembly fixture is made of the following items: support channel, berthing port, 1-axis gimbal, astromast and attachments. All the above items are made of aluminum and SIV-B simple adapter CERs used to calculate DDT&E and production costs for the support channel, astromast and attachments. The berthing port costs are calculated the same as they were on the power module. SIV-B skin/ring-stringer CERs were used on the 1-axis gimbal.

The costing approach for the electrical power subsystem is based on MDAC, Phase B electrical power costs and power module electrical power costs. The total electrical power cost calculated was split 25-75 between the power platform and the TA-2 antenna.

Adding the engineering support cost of $47.24 million to the power module hardware cost provides a total program cost of $138.80 million for the power platform.



COST:

POWER PLATFORM HARDWARE	$ 91.56
ENGINEERING SUPPORT	47.24
POWER PLATFORM	138.80
RCS PACKAGE	26.77
TOTAL PROGRAM	$165.56

CHARACTERISTICS:

WEIGHT
- TOTAL 10,557 KG (23,274 LB)
- POWER PLATFORM 8,489 KG (18,714 LB)
- RCS 1,347 KG (3,029 LB)

DIMENSIONS – POWER PLATFORM
- WIDTH 28 M (92 FT)
- HEIGHT 1 M (3.3 FT)
- LENGTH 149 M (489 FT)

AREA – BLANKET 3,576 M^2 (38,492 FT^2)

Figure 4-8. Power Platform and RCS Package

Table 4-5

POWER PLATFORM AND RCS PACKAGE

DATA FORM B
(FABRICATION AND ASSEMBLY IN SPACE)

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Hardware				
	Structure/Mechanical				
	Longerons	1,880(4,144)	kg (lb)	wt	SIV-B simple adapter CERs – Q = 4. Production – quantity = 4 and labor complexity factor applied.
	Cross Beams	346(763)	kg (lb)	wt	SIV-B simple adapter CERs – Q = 5. Production – quantity = 5 and labor complexity factor applied.
	Attachments	22(49)	kg (lb)	wt	
	Assembly Fixture				
	Supt Channel	1,194(2,500)	kg (lb)	wt	SIV-B simple adapter CERs.
	Berthing Port	100(220)	kg (lb)	wt	DDT&E – engineering judgment. Production – SIV-B simple adapter CER.
	1-Axis Gimbal	313(689)	kg (lb)	wt	SIV-B skin/ring/stringer CERs.
	Astromast	243(536)	kg (lb)	wt	SIV-B simple adapter CERs.
	Solar Cell Attachs	705(1,554)	kg (lb)	wt	SIV-B simple adapter CERs.
	Electrical Power				
	Solar Cells	3,576(38,492)	m^2 (ft^2)	Area	DDT&E – engineering judgment. Production – MDAC estimate x area.
	Batteries	6,240(13,757)	kg (lb)	wt	Based on 38 kw power module costs – DDT&E – adjusted by 0.50 x 0.25. Production – adjusted by weight x 0.25.
	Regulators	604(1,332)	kg (lb)	wt	Based on 38 kw power module. Cost – adjusted by weight x 0.25.
	Chargers				Based on 38 kw power module. Cost – Production – adjusted by weight x 0.25.
	Converters				Same as chargers.
	Switches				Same as chargers.
	RCS Package				
	Structure/Mechanical	1,085(2,392)	kg (lb)	wt	SIV-B simple adapter CERs – Qty = 4 NLC.
	Electrical Power	8(18)	kg (lb)	wt	V/M S/C power distribution CERs.
	Propulsion/RCS	281(619)	kg (lb)	wt	V/M S/C attitude control CERs.

The total program cost for the RCS package is $26.77 million. The RCS package is composed of the following subsystems: structure/mechanical, electrical power and propulsion/RCS. SIV-B simple adapter CERs were used to calculate the DDT&E and production costs for the structure/mechanical subsystem and unmanned spacecraft CERs for the electrical power (distribution) and propulsion/RCS subsystems.

Combining the costs, the total program cost for the power platform and RCS package is $165.56 million.

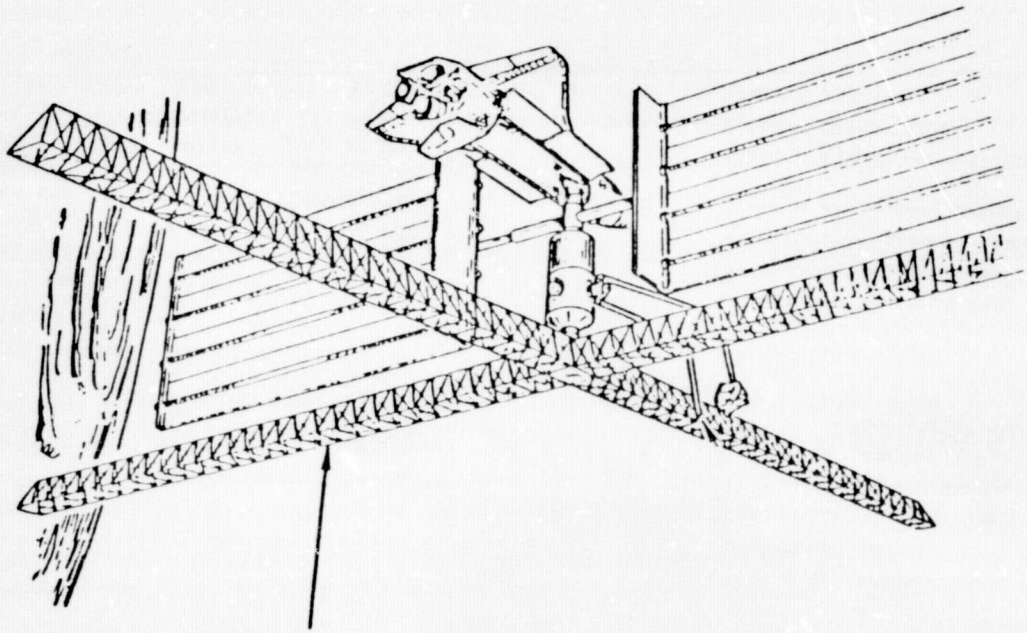
4.2.1.2 Test Article 1 Antenna

The total program cost for Test Article 1 (WBS 1X-300-10-02) with a breakdown by components, total system and component weights, antenna dimensions and solar array area is shown in Figure 4-9. Table 4-6 describes the TA-1 on NASA Form B.

The costing approach for Test Article 1 is based on an orbital construction concept definition of deploying and assembling the components in space.

The cost including DDT&E and ground production for the antenna hardware is $29.38 million. The antenna hardware is composed of the following subsystems: structure/mechanical, EC/LS and information. The structure/mechanical subsystem is constructed from 15 deployable sections and many panel leveling devices. The deployable sections are made from graphite/polymide composite material while the panel leveling devices are made from aluminum. SIV-B simple adapter CERs are used on both components to calculate the DDT&E and production costs with the composite complexity factor applied to the deployable sections production CER and a 90 percent learning curve applied to the panel leveling devices production CER. The EC/LS subsystem is passive and the unmanned spacecraft thermal control CERs are used to calculate the DDT&E and production costs. The information (telemetry) subsystem is composed of microwave components (aplitrons, waveguide panels, phase control electronics and waveguide phase shifter) and DDT&E and production costs are based on Raytheon estimates.

Adding the engineering support cost of $13.33 million provides a total program cost of $42.71 million for the TA-1 antenna.



COST:

ANTENNA HARDWARE	$ 29.38
ENGINEERING SUPPORT	13.33
SUBTOTAL	$ 42.71
PALLET	$ 19.38
FREE FLIGHT SUPPORT	223.68
TOTAL PROGRAM	$285.77

CHARACTERISTICS:

WEIGHT	
TOTAL	5,142 KG (11,336 LB)
LEO	2,564 KG (5,653 LB)
PALLET	972 KG (2,143 LB) KG
DIMENSIONS	
HORIZONTAL	123 M (404 FT)
VERTICAL	120 M (394 FT)
AREA-ARRAY	1000 M^2 (10,764 FT^2)

Figure 4-9. Test Article 1

Table 4-6

TEST ARTICLE 1 ANTENNA AND EQUIPMENT

DATA FORM B

TA-1 (ANTENNA H/W, PALLET, FREE FLIGHT SUPPORT SUBSYSTEM)

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Antenna Hardware				
	Structure/Mechanical	C			
	Sections and Display	810(1, 785)	kg (lb)	wt	SIV-B simple adapter CERs — Q = 15.
	Mech	C			Production — Quantity = 15 and composite complexity factor applied.
	Panel Level Devices	195(425)	kg (lb)	wt	SIV-B simple adapter CERs — Q = 60. Production — 90% learning curve apld.
	EC/LS	C 80(176)	kg (lb)	wt	V/M S/C thermal control CERs.
	Information (Telemetry)				Based on Raytheon Estimate.
	Pallet				
	Structure/Mechanical				
	Work Platform	332(733)	kg (lb)	wt	SIV-B simple adapter CERs.
	Shim Web	173(382)	kg (lb)	wt	SIV-B simple adapter CERs.
	Ribs	208(458)	kg (lb)	wt	SIV-B simple adapter CERs.
	Track	45(100)	kg (lb)	wt	SIV-B simple adapter CERs.
	Attachments	114(251)	kg (lb)	wt	SIV-B simple adapter CERs.
	Berthing Port	100(220)	kg (lb)	wt	DDT&E — engineering judgment. Production — SIV-B simple adapter CERs.
	Full Flt Supt System				
	Structure/Mechanical				
	Shell	1, 031(2, 273)	kg (lb)	wt	SIV-B simple adapter CERs.
	Attachments	52(115)	kg (lb)	wt	SIV-B simple adapter CERs.
	EC/LS	46(101)	kg (lb)	wt	V/M S/C environmental control CERs.
	Electrical Power				Based on 38 kw power module — 38 kw costs — radiator.
	Propulsion/RCS	84(185)	kg (lb)	wt	V/M S/C attitude control CERs.
	Guidance and Control	371(817)	kg (lb)	wt	V/M S/C GNSC CERs.
	Information (Telemetry)	22(48)	kg (lb)	wt	V/M S/C TTC CERs.

The total program cost for the supplies pallet (WBS 1X-300-10-02-03) is $19.38 million. The pallet is made of the following parts: work platform, shear web, ribs, track, attachments and berthing port. SIV-B simple adapter CERs are used to calculate all the DDT&E and production costs equal the berthing port DDT&E cost which was estimated to be very small since many berthing ports are utilized in this study.

The total program cost for the free flight support system (WBS 1X-300-10-02-04) is $223.68 million. The free flight support system for TA-1 is composed of three subsystems: structure/mechanical, EC/LS and information (telemetry). The structure/mechanical subsystem is made of a shell and its attachments. SIV-B simple adapter CERs are used to calculate the DDT&E and production costs. The two other subsystems and unmanned spacecraft CERs to calculate the DDT&E and production costs.

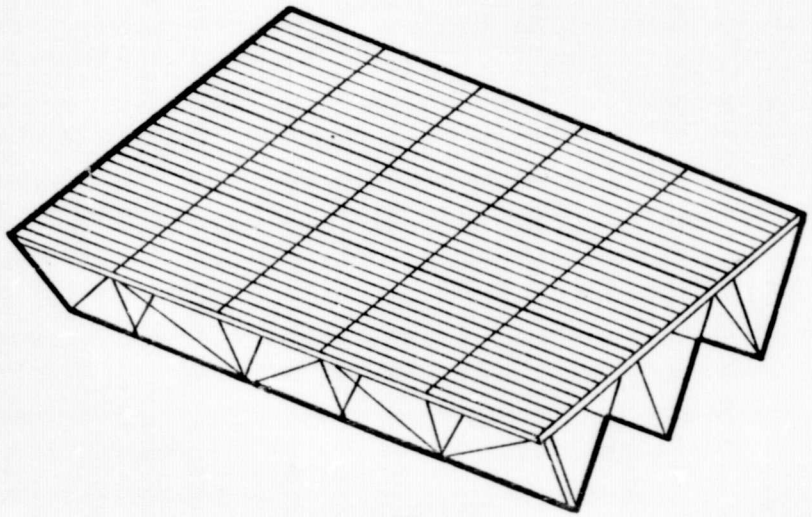
The total program cost for Test Article 1 project is equal to $285.77 million.

4.2.1.3 Test Article 2 Antenna

The total program cost for Test Article 2 (WBS 1X-300-10-03) with a breakdown by components, total system and components weights and antenna area is shown in Figure 4-10. Table 4-7 describes the TA-2 on NASA Form B.

The costing approach for Test Article 2 antenna is based on an orbital construction concept definition of deploying and assembling the components in space.

The cost including DDT&E and production for the antenna hardware (WBS 1X-300-10-03-01) is $86.12 million. The antenna hardware is composed of the following subsystems: structure/mechanical, EC/LS, electrical power, propulsion/RCS and information (telemetry). The structure/mechanical subsystem is constructed from three deployable sections and many panel leveling devices on a foldout pallet. The deployable sections are made from graphite/polymide composite material while the panel leveling devices are made from aluminum. As with TA-1 SIV-B simple adapter CERs are used on both components to calculate the DDT&E and production costs with the composite complexity factor applied to the deployable sections production



COST:

ANTENNA HARDWARE	$ 86.12
ENGINEERING SUPPORT	33.32
SUBTOTAL	$119.44
PALLET	12.57
TOTAL PROGRAM	$132.01

CHARACTERISTICS:

WEIGHT	
TOTAL	11,306 KG (24,925 LB)
PALLET	450 KG (991 LB)
DIMENSIONS	
HEIGHT	3.3 M (10.8 FT)
WIDTH	9.0 M (29.5 FT)
LENGTH	14.4 M (47.2 FT)
AREA-ANTENNA	129.6 M^2 (1,395 FT^2)

Figure 4-10. Test Article 2 Antenna

MCDONNELL DOUGLAS

Table 4-7

TA-2 ANTENNA AND EQUIPMENT

DATA FORM B
(ANTENNA H/W AND SUPPLIES PALLET) (DEPLOY AND ASSEMBLE IN SPACE)

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Antenna Hardware				
	Structure/Mechanical				
	Antenna	438(996)	kg (lb)	wt	SIV-B simple adapter CERs — Q = 3. Production — composite complexity factors applied.
	Panel Level Device	126(278)	kg (lb)	wt	DDT&E — engineering judgment. Production — SIV-B simple adapter CER. Composite complexity factor applied.
	Rotary (3 axis)	625(1, 378)	kg (lb)	wt	SIV-B skin/ring/stringer CERs x 2.
	Berthing Port	100(220)	kg (lb)	wt	DDT&E — engineering judgment. Production — SIV-B simple adapter CERs.
	Foldout Pallet				
	"T" Section Track	103(228)	kg (lb)	wt	SIV-B simple adapter CERs — Q = 2.
	" " Section Track	103(228)	kg (lb)	wt	SIV-B simple adapter CERs.
	" " Section Track	79(175)	kg (lb)	wt	SIV-B simple adapter CERs.
	Cross Beams	241(532)	kg (lb)	wt	SIV-B simple adapter CERs — Q = 20. Production — 90% learning curve applied.
	Attachments	132(291)	kg (lb)	wt	SIV-B skin/ring/stringer CERs.
	Docking Port	100(220)	kg (lb)	wt	SIV-B skin/ring/stringer CERs.
	Misc Support	76(168)	kg (lb)	wt	SIV-B simple adapter CERs.
	EC/LS	188(414)	kg (lb)	wt	V/M S/C Environmental control CERs.
	Electrical Power (Battery, Regulators, Chargers, Converters, Switches)				Same as 100 kw Power Platform Electrical Power costs x 3.
	Propulsion/RCS	23(50)	kg (lb)	wt	V/M S/C attitude control CERs.
	Information (telemetry)				Same as TA-1 Antenna H/W.
	Supplies Pallet				
	Structure/Mechanical	450(991)	kg (lb)	wt	Similar to Foldout Pallet — Total — Tracks — Docking Port.

CER and a 90 percent learning curve applied to the panel leveling devices production CER. The foldout pallet not only helps deploy the antenna structure but also becomes part of the antenna support structure once the construction of the antenna is completed. The foldout pallet is made of the following pieces: "T," "square" and "rectangular" shaped tracks, cross beams, attachments, miscellaneous support and docking port. All of the above pieces are made of aluminum with SIV-B simple adapter CERs used to calculate DDT&E and production costs except for attachments and the docking port. SIV-B skin/ring/shifter CERs are used to calculate DDT&E and production costs for these two items. A 90 percent learning curve was applied to the production CER of the cross beams.

The EC/LS and production/RCS subsystems are very similar to the subsystem used on TA-1 with unmanned spacecraft CERs being applied to calculate the DDT&E and production costs. The electrical power subsystem is equal to 3/4 of the cost of the electrical power subsystem for the power platform. Since only 1/4 of that cost was assigned to the power platform, the 3/4 is assigned to the TA-2 antenna. The information (telemetry) subsystem is the same as used on the TA-1 antenna hardware.

Adding the engineering support cost of $33.32 million for the antenna provides the total program cost of $119.44 for the TA-2 antenna only.

The total program cost for the supplies pallet (WBS 1X-300-10-03-03) is $12.57 million. The pallet is the same as the foldout pallet as the TA-1 pallet except the tracks and docking port have been deleted.

The total program cost for Test Article 2 antenna project is equal to $132.01 million.

4.2.1.4 Beam Mapping Satellites (BMS)

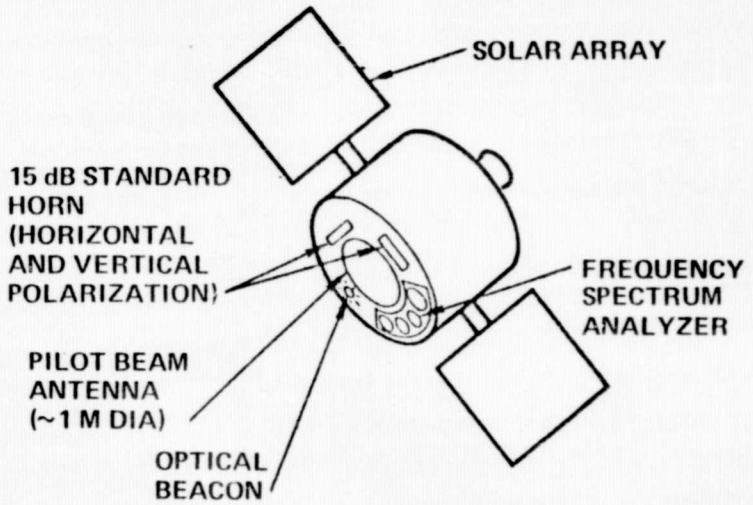
The total program cost with a breakdown for the Small (WBS 1X-300-10-04) and 360M BMS (WBS 1X-300-10-05) and component weights is shown in Figure 4-11. Table 4-8 describes the BMS's on NASA Form B.

COST:

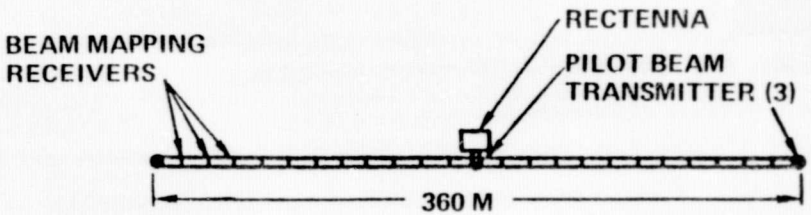
SMALL BMS (BMS-QC)	
HARDWARE	$13.65
ENGINEERING SUPPORT	4.84
TOTAL PROGRAM	$18.49
360 M BMS (BMS-C)	
HARDWARE	$24.32
ENGINEERING SUPPORT	11.15
SUBTOTAL	$35.47
FREE FLIGHT SUPPORT	57.69
TOTAL PROGRAM	$93.17

CHARACTERISTICS:

TOTAL WEIGHT	
SMALL BMS	1,000 KG (2,205 LB)
360 M BMS	2,748 KG (6,058 LB)



QUASI-CLOSED LOOP BMS (BMS-QC)



CLOSED LOOP BMS (BMS-C)

Figure 4-11. Beam Mapping Satellites (BMS)

Table 4-8

BMS EQUIPMENT

DATA FORM B

(SMALL 360m PLUS FREE FLIGHT SUPPORT SYSTEM) (FABRICATION AND ASSEMBLY IN SPACE)

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Small BMS	1	each		Based on multimission module — engineering estimate.
	360M BMS				
	Hardware				
	Structure/Mechanical				Based on power platform —
	All except assembly fixture				0.50 x total cost.
	Assembly Fixture				0.20 x total cost.
	Information (telemetry)				Engineering and cost analyst judgment.
	Full Flt Supt System	1	set		
	Electrical Power				Based on power module — Engineering judgment.
	Guidance and Control				Based on power module.
	RCS				Based on power module.
	Information (telemetry)				Based on power module.

The costing approach used for the small BMS is based on engineering judgment. The costing approach used for the 360 meter BMS is based on an orbital construction concept definition of fabricating the components on the ground and assembling them in space.

The cost of modifying the Multi-Mission Module including DDT&E and production for the small BMS is $13.65 million. The cost estimate is based on engineering judgment. Adding the Engineering Support cost of $4.84 million provides the total program cost of $18.49 million.

The 360M BMS is composed of two parts: hardware and full flight support system. The total base cost for the hardware is $24.32 million. The hardware component contains two subsystems: structure/mechanical and information (telemetry). The structure/mechanical subsystem cost is based on the power platform DDT&E cost set at 50 percent of the power platform DDT&E cost and the production cost set at 10 percent of the power platform production cost. The information (telemetry) subsystem cost is based on engineering judgment.

Adding the engineering support cost of $11.15 million provides the total program cost of $35.47 for the 360 BMS with its free flight support system.

The total program cost of the full flight support system is $57.69 million. The full flight support system is composed of the following subsystems: electrical power, guidance and control, propulsion/RCS and information (telemetry). The cost of these subsystems is based on the power module. The total program cost of the 360 BMS is $93.17 million.

The total program cost for the beam mapping satellites is equal to $111.66 (18.49 + 93.17) million.

4.2.2 Earth Services

The total cost of the Earth Services group (WBS 1X-300-20) is $819.50 million. It is composed of three projects: the 30 meter Radiometer (WBS 1X-300-20-01) costing $239.68 million, the 100 meter Radiometer (WBS 1X-300-20-02) costing $299.15 million and the 27 meter Multi-Beam Lens

(WBS 1X-300-20-03) costing $280.6 million. These costs include the end item itself, the required special tooling and the engineering support. They do not include the prorata part of the management and integration or the launch and flight operations.

4.2.2.1 30 Meter Radiometer

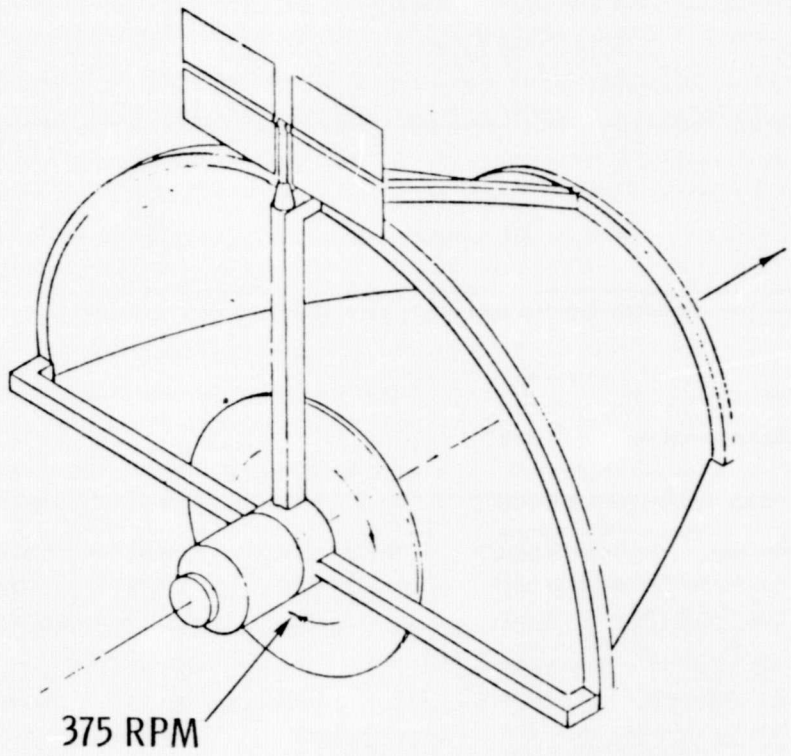
The total program cost for the 30 Meter Radiometer (WBS 1X-300-20-01) with a breakdown by components, total system and module weights and array area is shown on Figure 4-12. Table 4-9 describes the 30 Meter Radiometer on NASA Form B.

The costing approach for the 30m radiometer is based on an orbital construction concept definition of fabricating the components on the ground and assembling them in space.

The cost including DDT&E and ground production for the hardware is $80.60 million. The hardware is composed entirely of structure, the parts being: antenna shell, support structure, wheel and counterbalance, berthing port and module. The antenna shell is composed of 15 panels made of graphite/epoxy composite material and covered with a silver sprayed surface. SIV-B simple adapter CERs are used to calculate the DDT&E and production costs with a composite complexity factor and 90 percent learning curve factor applied to the production CER.

The support structure is composed of the most, 3-cross beams, 2-15m frames, 2-7.34m frames and longeron. The wall is made of aluminum while the rest of the components are made of graphite/epoxy composite material. SIV-B simple adapter CERs are selected to calculate the DDT&E and production costs with a composite complexity factor applied to the production CER.

The wheel and counterbalance is composed of the wheel assembly and countermass. Both components are made of aluminum and SIV-B simple adapter CERs are used to calculate the DDT&E and production costs.



COST:	
HARDWARE	$ 80.60
ENGINEERING SUPPORT	$ 37.45
SUBTOTAL	$118.05
FREE FLIGHT SUPPORT	$121.64
TOTAL PROGRAM	$239.69

CHARACTERISTICS:	
WEIGHT	
TOTAL	23,159 KG (51,057 LB)
FREE FLIGHT SUPPORT	10,025 KG (22,101 LB)
DIMENSIONS-MODULE	
LENGTH	6.2 M (20.3 FT)
DIAMETER	4.3 M (14.1 FT)
AREA-ARRAY	1000 M^2 (10.764) FT^2)

Figure 4-12. 30 Meter Radiometer

Table 4-9

30 METER RADIOMETER PROJECT

DATA FORM B
(FABRICATION ON GROUND, ASSEMBLY IN SPACE)

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Hardware				
	Structure/Mechanical				
	Antenna Shell	5,816(12,821)	kg (lb)	wt	SIV-B simple adapter CERs – Q = 15. Production 90% learning curve and composite complexity factor applied.
	Mast	696(1,535)	kg (lb)	wt	SIV-B simple adapter CERs.
	Cross Beams	1,045(2,303)	kg (lb)	wt	SIV-B simple adapter CERs – Q = 3. Production – composite complexity factor applied.
	15m Frame Assy	1,258(2,744)	kg (lb)	wt	SIV-B simple adapter CERs – Q = 2. Production – composite complexity factor applied.
	7.34m Frame Assy	620(1,412)	kg (lb)	wt	Same as 15m frame assembly.
	Longeron	777(1,713)	kg (lb)	wt	SIV-B simple adapter CERs – Production – composite complexity factor applied.
	Wheel Assembly	2,134(4,705)	kg (lb)	wt	SIV-B simple adapter CERs.
	Countermass	214(471)	kg (lb)	wt	SIV-B simple adapter CERs.
	Berthing Port	100(220)	kg (lb)	wt	DDT&E engineering judgment. Production – SIV-B simple adapter CER.
	Module	454(1,001)	kg (lb)	wt	SIV-B simple adapter CERs.
	Free Flight Supt Sys				
	EC/LS				Based on 38 kw power module.
	Electrical Power				DDT&E = Total x 0.5.
	Guidance and Control				Production = Total.
	Propulsion/RCS				
	Information (telemetry)				

The control module including the berthing port contains the full flight support system. SIV-B simple adapter CERs are used to calculate the module base costs and the procedure described in power module to calculate the berthing port base cost.

Adding the engineering support cost of $37.45 million provides a total program cost of $118.05 million for the 30 meter unit only.

The total program cost of the free flight support system (WBS 1X-300-20-01-04) is $121.64 million. The free flight support system is composed of five subsystems: EC/LS, electrical power, guidance and control, propulsion/RCS and information (telemetry). Case costs for these subsystems are based on the power module; thus, DDT&E and production costs are set equal to the full flight support system for the power module with the DDT&E cost reduced by 50 percent due to commonality.

The total program cost for the 30 meter radiometer project is $239.69 million.

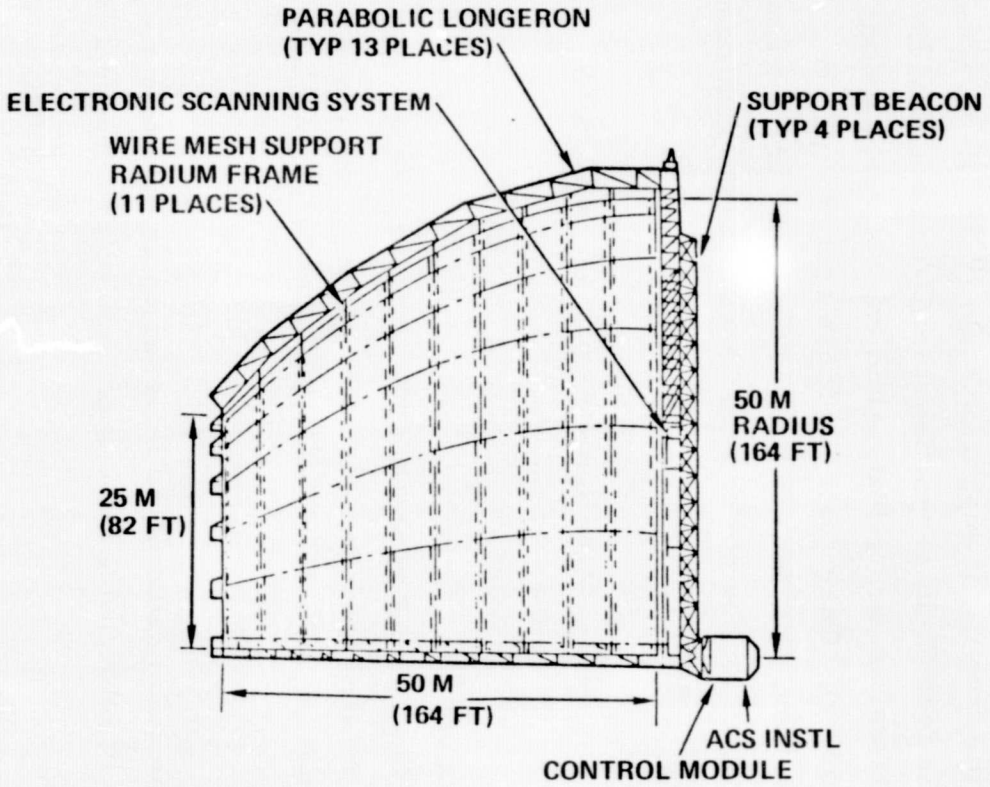
4.2.2.2 100 Meter Radiometer

The total program cost for the 100m Radiometer (WBS 1X-300-20-02) with a breakdown by components, total system weight, tooling weight and module weight is shown in Figure 4-13. Table 4-10 describes the 100m Radiometer on NASA Form C.

The costing approach for the 100m radiometer is based on an orbital construction concept definition of fabricating the components on the ground and assembling them in space.

The cost including DDT&E and ground production for the hardware is $76.92 million. The hardware cost is based on the 30m radiometer design with the DDT&E cost set equal to 50 percent of the 30m radiometer DDT&E cost. The production cost was calculated using the same structural pieces and CERs used on the 30m radiometer.

Add the engineering support cost of $45.28 million provides the total program cost of $122.20 million for the 100 meter unit only.



COST:

HARDWARE	$ 76.92
ENGINEERING SUPPORT	45.28
SUBTOTAL	$122.20
STRONGBACK EXTENSION	2.21
FREE FLIGHT SUPPORT	168.75
TOTAL PROGRAM	$229.16

CHARACTERISTICS:

WEIGHT	
TOTAL	36,069 KG (79,519 LB)
STRONGBACK EXTENSION	1,630 KG (3,594 LB)
DIMENSIONS	
HEIGHT	9 M (29.5 FT)
DIAMETER	4.4 M (29.5 FT)
AREA-ARRAY	1,000 M^2 (10,764 FT^2)

Figure 4-13. 100 Meter Radiometer

Table 4-10

100-METER RADIOMETER PROJECT

DATA FORM B
(FABRICATION ON GROUND, ASSEMBLY IN SPACE)

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Hardware				
	Structure/Mechanical				Based on 30m Radiometer – Total x 0.50.
	DDT&E				
	Production				
	Antenna Shell	15,510(34,193)	kg (lb)	wt	SIV-B simple adapter CERs – Q = 15. Production – 90% learning curve and labor complexity factor and composite complexity factor applied.
	Mast	1,857(4,093)	kg (lb)	wt	SIV-B simple adapter CERs – Production – labor complexity factor applied.
	Supt Beams	3,715(8,191)	kg (lb)	wt	SIV-B simple adapter CERs – Q = 4. Production – 90% learning curve, composite complexity factor applied.
	Frame	3,320(7,320)	kg (lb)	wt	SIV-B simple adapter CERs – Q = 2. Production – 90% learning curve, composite complexity factor and labor complexity factor applied.
	Longeron	2,072(4,567)	kg (lb)	wt	SIV-B simple adapter CERs – Production – composite complexity factor and labor complexity factor applied.
	Wheel Assy	5,691(12,546)	kg (lb)	wt	SIV-B simple adapter CERs – Production – labor complexity factor applied.
	Countermass	568(1,252)	kg (lb)	wt	SIV-B simple adapter CERs – Production – labor complexity factor applied.
	Berthing Port	100(220)	kg (lb)	wt	SIV-B simple adapter CER.
	Structural Extension				
	Structure/Mechanical				
	Beam	1,400(3,086)	kg (lb)	wt	SIV-B simple adapter CERs – Q = 2.
	Hinge	230(507)	kg (lb)	wt	Based on turntable. DDT&E – Total ÷ 2.
	Free Flight Supt System				
	Structure/Mechanical				Based on TA-1 antenna.
	EC/LS				DDT&E = Total x 0.5.
	Electrical Power				Production = Total.
	Propulsion/RCS				
	Guidance and Control				
	Information (telemetry)				

The total program cost for the strongback extension is $8.21 million. The strongback extension is composed of an assembly beam and a hinge mechanism. The assembly beam cost is based on the strongback. The hinge mechanism cost was based on the indexing turntable.

The total production cost of the free flight support system is estimated at $168.75 million. The free flight support system is composed of the following subsystems: structure/mechanical, EC/LS, electrical power, propulsion/RCS, guidance and control and information (telemetry). The base cost for the above subsystems is based on the TA-1 antenna full flight support system with the DDT&E portion set at 50 percent of the TA-1 antenna DDT&E cost.

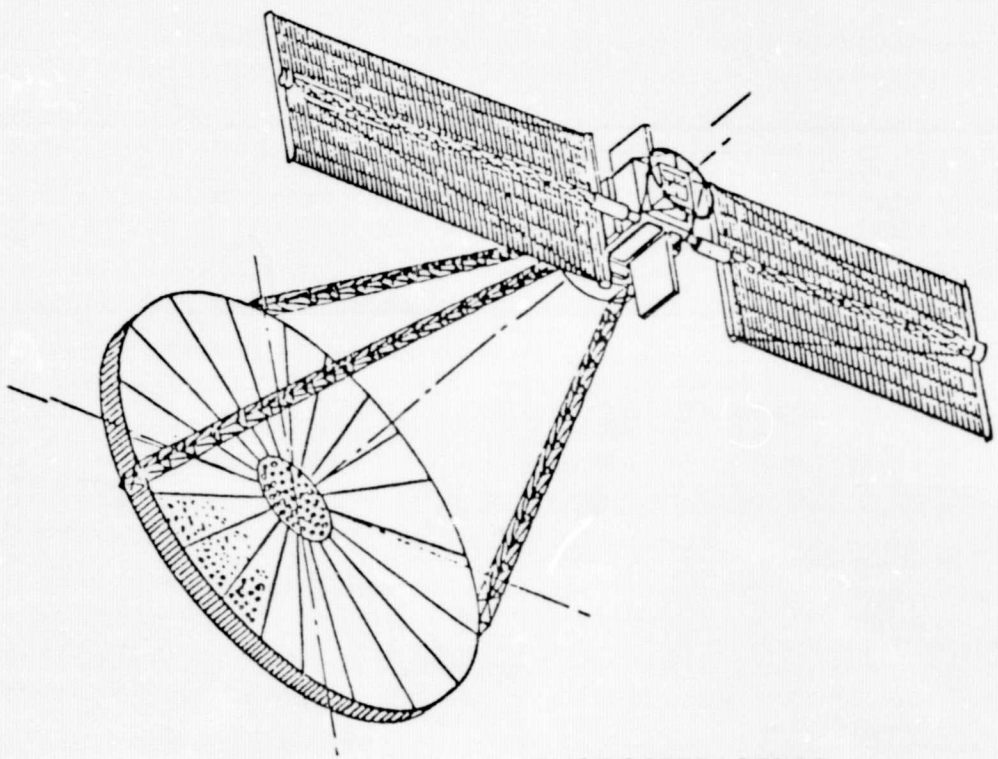
The total program cost for the 100 meter radiometer project is $299.15.

4.2.2.3 27 Meter Multi-Beam Lens (MBL)

The total program cost for the 27 meter Multi-Beam Lens (WBS 1X-300-20-03) with a breakdown by components, total system weight and module weight is shown in Figure 4-14. Table 4-11 describes the 27 meter MBL on NASA Form B.

The costing approach for the 27m MBL is based on an orbital construction concept definition of fabricating the components on the ground and assembling them in space.

The cost including DDT&E and ground production for the hardware (WBS 1X-300-20-03-01) is $69.06 million. The hardware component is made entirely of structural/mechanical subsystems, the parts being: lens, truss beams, module and berthing port. The lens is composed of 27 honeycomb panels made of graphite/epoxy composite material support structure and fall sheets containing 600,000 elements. SIV-B simple adapter CERs are used to calculate the DDT&E and production costs with a composite complexity factor and 90 percent learning curve factor applied to the production CER.



COST:		CHARACTERISTICS:	
HARDWARE	$ 69.06	WEIGHT	
ENGINEERING SUPPORT	42.86	TOTAL	29,417 KG (64,853 LB)
		FREE FLIGHT SUPPORT	1,606 KG (3,541 LB)
SUBTOTAL	$112.92	DIMENSIONS	
		DIAMETER	3.7 M (12.0 FT)
FREE FLIGHT SUPPORT	$168.75	HEIGHT	4.0 M (13.1 FT)
		ARRAY AREA	1000 M^2 (10,764 FT^2)
TOTAL PROGRAM	$280.67		

Figure 4-14. 27 Meter Multi-Beam Lens

MCDONNELL DOUGLAS

Table 4-11

27M MULTI-BEAM LENS PROJECT

DATA FORM B
(FABRICATION ON GROUND, ASSEMBLY IN SPACE)

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Hardware				
	Structure/Mechanical				
	Lens	26,649(58,750)	kg (lb)	wt	SIV-B simple adapter CERs — Q = 27. Production — 90% learning curve and composite complexity factor applied.
	Truss Beams	835(1,840)	kg (lb)	wt	SIV-B simple adapter CERs — Q = 3. Production — composite complexity factor applied.
	Module	227(500)	kg (lb)	wt	SIV-B simple adapter CERs.
	Berthing Port	100(220)	kg (lb)	wt	DDT&E — engineering judgment. Production — SIV-B simple adapter CER.
	Free Flight Supt System				
	Structure/Mechanical				Based on TA-1 Antenna.
	EC/LS				DDT&E — Total x 0.5.
	Electrical Power				Production — Total.
	Propulsion/RCS				
	Guidance and Control				
	Information (telemetry)				

Three one-meter triangular truss beams are made of graphite/epoxy composite material and also use SIV-B simple adapter CERs with a composite complexity factor applied to the production CER. The module and berthing port are standard designs with SIV-B simple adapter CERs and engineering judgment used to calculate DDT&E and production costs.

Adding the engineering support cost of $42.86 million provides a total program cost of $118.05 for the 27 meter unit only.

The total program cost of the free flight support system (WBS 1X-300-20-03-04) is $168.75 million. The cost of the free flight support system is based on the TA-1 antenna free flight support system with the DDT&E cost reduced by 50 percent for commonality.

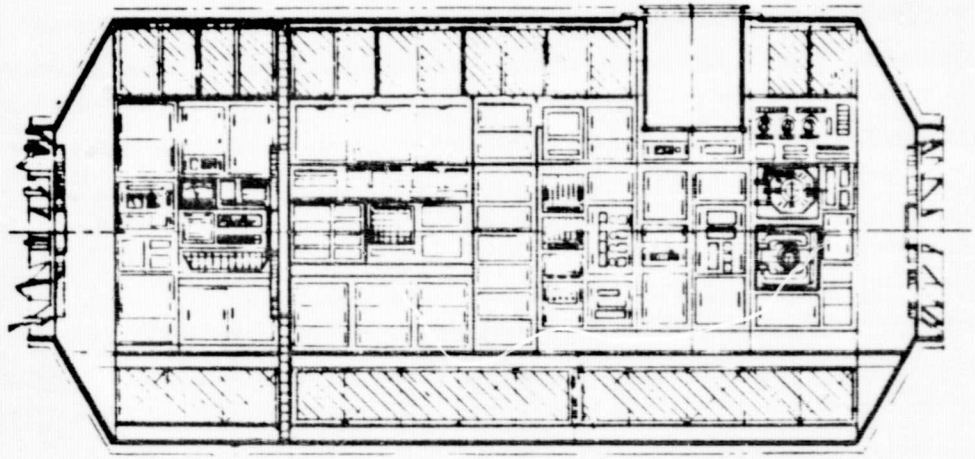
The total program cost for the 27 meter multi-beam lens project is $280.67 million.

4.2.3 Space Processing and Science

The Space Processing and Science group (WBS 1X-300-30) is composed of two projects, the Spacelab (WBS 1X-300-30-01) which is assumed to be GFE and the Space Processing Engineering Development Facility (WBS 1X-300-30-02).

The total program cost, assembly costs, and a profile view of the SPEDF are shown in Figure 4-15. Table 4-12 describes the SPEDF on NASA Form B.

Each of the subsystems, especially in the Information and Communications Subsystem, contain a maximum number of off-the-shelf type assemblies, subassemblies, and components. Maximum use has been made of off-the-shelf type items from the Orbiter, as well as from other programs. This permits a large reduction in DDT&E costs since these costs reflect the advantage of considering previous design and development effort. Cost avoidance, therefore, is a large factor in DDT&E costs.



COST:

HARDWARE	$ 99.21
ENGINEERING SUPPORT	43.94
TOTAL PROGRAM	$143.15

CHARACTERISTICS:

OVERALL LENGTH = 9 M (29.5 FEET)

TOTAL WEIGHT = 9570 KG (21,100 LB)

Figure 4-15. Space Processing Engineering Development Facilities

Table 4-12 (Page 1 of 2)

SPACE PROCESSING ENGINEERING DEVELOPMENT FACILITY

DATA FORM B

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	SPEDF				
	Structure/Mechanical				
	• Primary	9(29.5)	m (ft)	Length	Based on Phase B MSS Control Center Map (CC No. 2) DDT&E and production costs and adjusted for an increase in length.
	• Secondary	9(29.5)	m (ft)	Length	Same logic as for primary.
	• Shield	9(29.5)	m (ft)	Length	Same logic as for primary.
	• Berthing	2	Units		Based on Phase B MSS CC No. 2 reference costs DDT&E and production costs remain unaltered.
	• Airlock	1	Each	2 Man	Based on Part 2 Airlock costs. DDT&E costs adjusted for previous design impact. DDT&E and production costs adjusted for smaller size of SPEDF airlock.
	• Storage	1	Set		DDT&E and production costs derived using volume as a cost parameter and Spacelab cabinet costs as a reference.
	• Subsystems Cabinet	1	Set		Based on Spacelab Double Rack DDT&E and production costs of similar size and complexity.
	EC/LS				
	• Atmosphere Control	1	Set	7 Man	Same logic as for CS atmosphere control.
	• Thermal Control				Same logic as for CS thermal control.
	• Additional Thermal Control Loop				Based on Phase B Freon Loop reference costs. DDT&E and production costs remain unaltered.
	Electrical Power				
	• Distribution, Wiring, Misc	1	Set	30 kw	Based on Phase B MSS SM-1 costs. DDT&E and production costs remain unaltered.
	Information				
	• Data Processing	1	Set		Same logic as for SCM data processing.
	• Controls/Displays				Same logic as for SCM displays/controls.
	• Communications				Same logic as for SCM communications.

Table 4-12 (Page 2 of 2)

SPACE PROCESSING ENGINEERING DEVELOPMENT FACILITY

DATA FORM B

WBS Identification No.	WBS Identification	Quantity or Value	Units of Measure	Characteristics	Notes
	Equipment (MDAC)	1	Set		
	• Facility Control Equip.				
	– Power Conditioning				Unmanned spacecraft CER's.
	– Thermal Control				Unmanned spacecraft CER's.
	– Data Acquisition Assembly				Cost Analyst/engineering estimate.
	– Process Control Assy				Cost Analyst/engineering estimate.
	– Master Control Assy				Cost Analyst/engineering estimate
	– Processing Work Stat.				Spacelab Analytical Work Station cost
	Equipment (GFE)	1	Set		Costs for equipment not included. Costs are approximated so that integration costs may be obtained.
	• Primate Holding Facility				Spacelab primate holding facility costs.
	• Small Vertebrate Holding Facility				Spacelab small vertebrate holding facility costs.
	• General Experiments and Surgical Work Bench	1	Each		Spacelab general experiments and surgical work bench costs.
	• Biological Processing Facility Equipment				Built-up costs using Spacelab components costs.
	• Crew Status	1	Set		Engineering estimate.
	• Emergency Equipment	1	Set		Engineering estimate.
	• Containerless Processing Facility Equipment				Engineering estimate.

The total subsystem cost for the SPEDF, for both DDT&E and production is $99.21 million.

The structural/mechanical subsystem (S/MS cost is $22.05 million. The primary and secondary structure, shield, berthing costs are based on the Phase B MSS Control Center No. 2 (CC No. 2) costs. These costs assume previous design and development and production of similar SCM and CS structures. The airlock costs are assumed the same as for the CS airlock. The subsystem cabinet is very similar to the Spacelab Standard Rack in both size and shape, so the standard rack costs are used. All of the storage structure is costed using the standard rack costs, with volume being the cost parameter.

The total EC/LSS cost is $22.65 million. The atmosphere control and thermal control assemblies for the CS and SPEDF are similar so that CS costs are used for both the SPEDF DDT&E and production costs. An additional high temperature thermal control assembly is required for the SPEDF. The reference costs for the freon loop have been used for both DDT&E and production.

The total EPS costs are $15.10 million. It is assumed that the requirements for the Phase B MSS-SM-1 module are similar to the SPEDF requirements, therefore, the SM-1 DDT&E and production costs are used.

The total Information Subsystem cost is $10.00 million. This is a cost based on comparison of the SCM and CS subsystems with the SPEDF subsystem. The SPEDF subsystem requires more components than does the SCM, but less than the CS. Also the design and development on the SPEDF will have been performed previously on the SCM and the SC so that SPEDF DDT&E costs are significantly small. The production costs are very close to the SCM costs since the number and type of components are more similar to the SCM than to the SC.

The Facility Control Equipment and the Processing Work Station are two equipments that are used in support of the experiments. The Facility Control Equipment consists of: a power conditioning system and thermal control

equipment, costs for both being determined by appropriate CER's based on historical data; and data acquisition, process control, and master control assemblies costs being estimated by engineering personnel and the cost analyst. The total equipment base cost is $26.30 million.

GFE experiments costs are excluded from the total cost. However, a reasonable estimate was made of their total base cost since they were required to obtain integration costs that is included in the total costs.

Adding the engineering support cost of $43.94 million provides total program cost of $143.15 million for the SPEDF.

Section 5

PROGRAM SCHEDULE

The Space Construction Base (Space Station Program) provides schedule flexibility between the Shuttle-Tended and Continuously Manned modes of operation. This flexibility is depicted in the following typical schedules 1 and 2 (Figures 5-1 and 5-2). The decision of when to place the Construction Shack in orbit would be based on funding considerations and the planned buildup rate of mission activities. The program as scheduled would cost less for Typical 1 schedule because of the extra Shuttle-Tended launches in Typical 2 schedule, but this is highly dependent on a continuous mission profile being assumed. The following groundrules and assumptions are made for these schedules:

- ATP was assumed to be 1 October 1979, with the first launch at start of January 1984. This 51 month development program is considered of nominal length based on a combination of controlled funding buildup with utilization of existing hardware and gained experience on previous programs and is therefore somewhat shorter than prior major programs.
- For both schedules the Power Module free flyer is assumed to be built early and made available for the SCB Program.
- The station buildup on both schedules was based on a launch every 30 days. The activity during Shuttle-Tended phase on Typical 2 schedule also required a launch every 30 days. Once the station is continuously manned, the required launches are reduced.
- First priority on both schedules was given to Space Construction of Space Power mission items with Space Processing started in parallel as soon as the Construction Shack is available.
- Construction activity was based on constructing one objective element at a time. Optimizing the use of the Space Construction module builds the objective elements in series with the initiation of testing of one objective element while the next one is being fabricated.

POLDOC FRAME 1

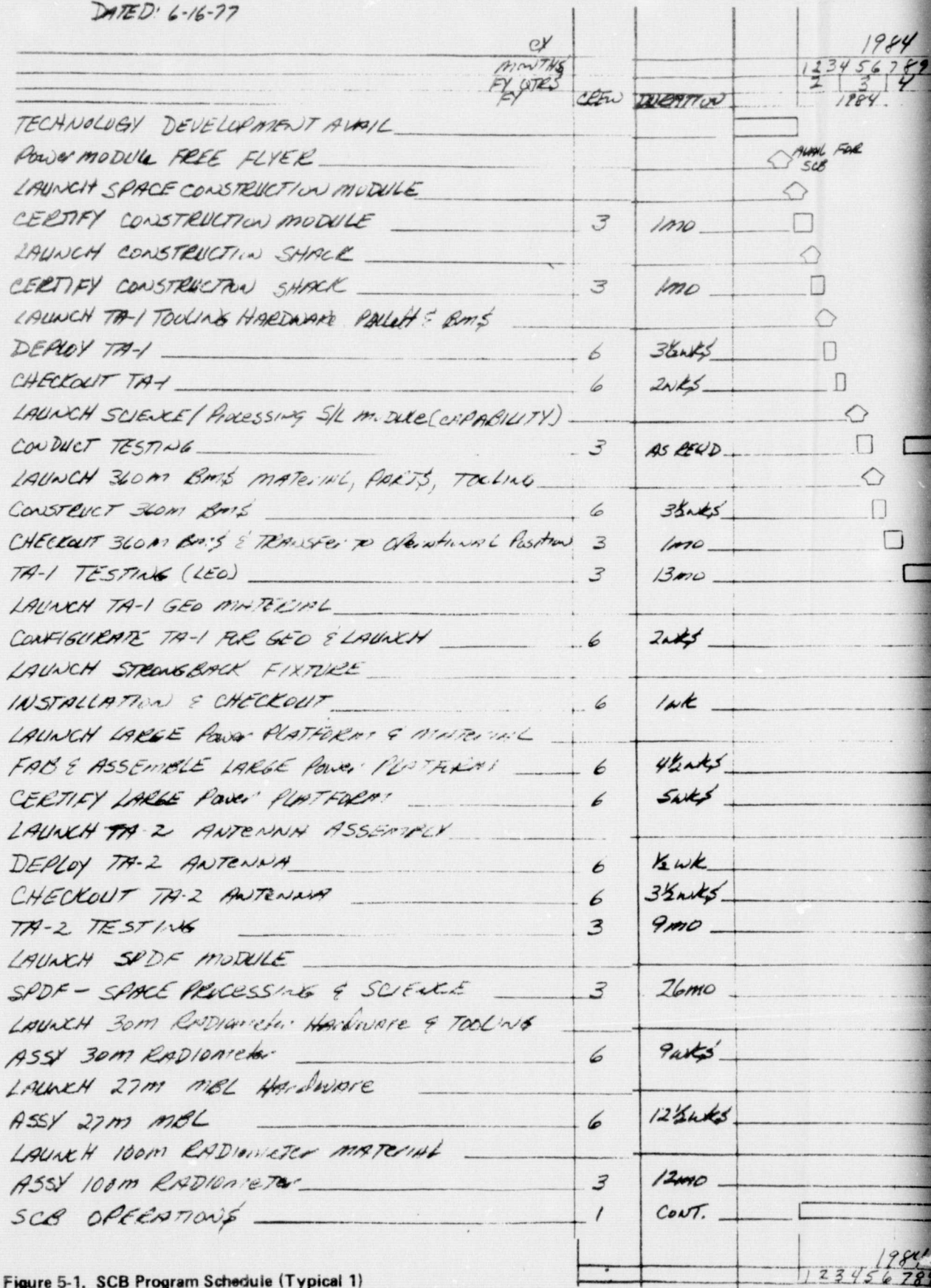
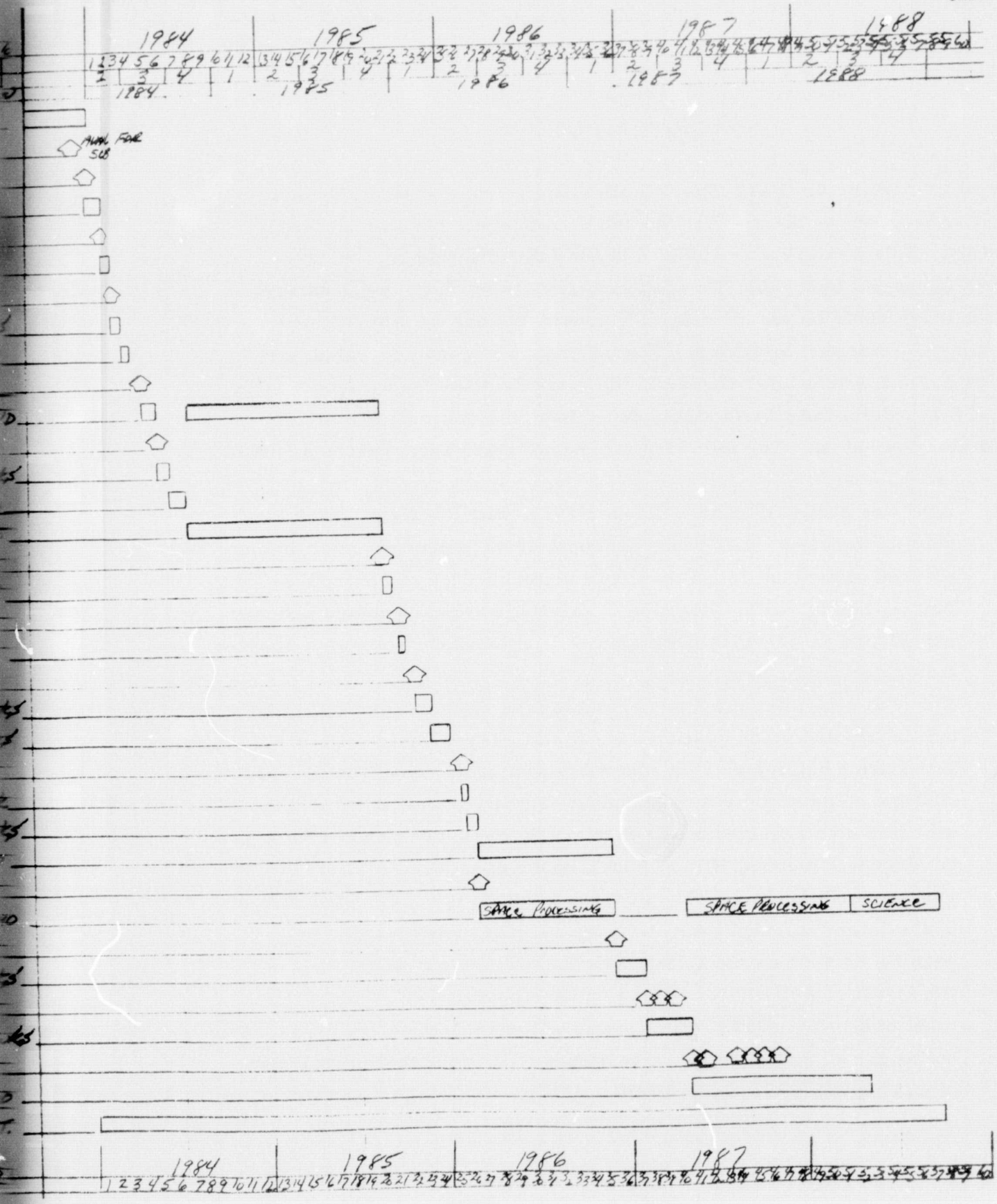


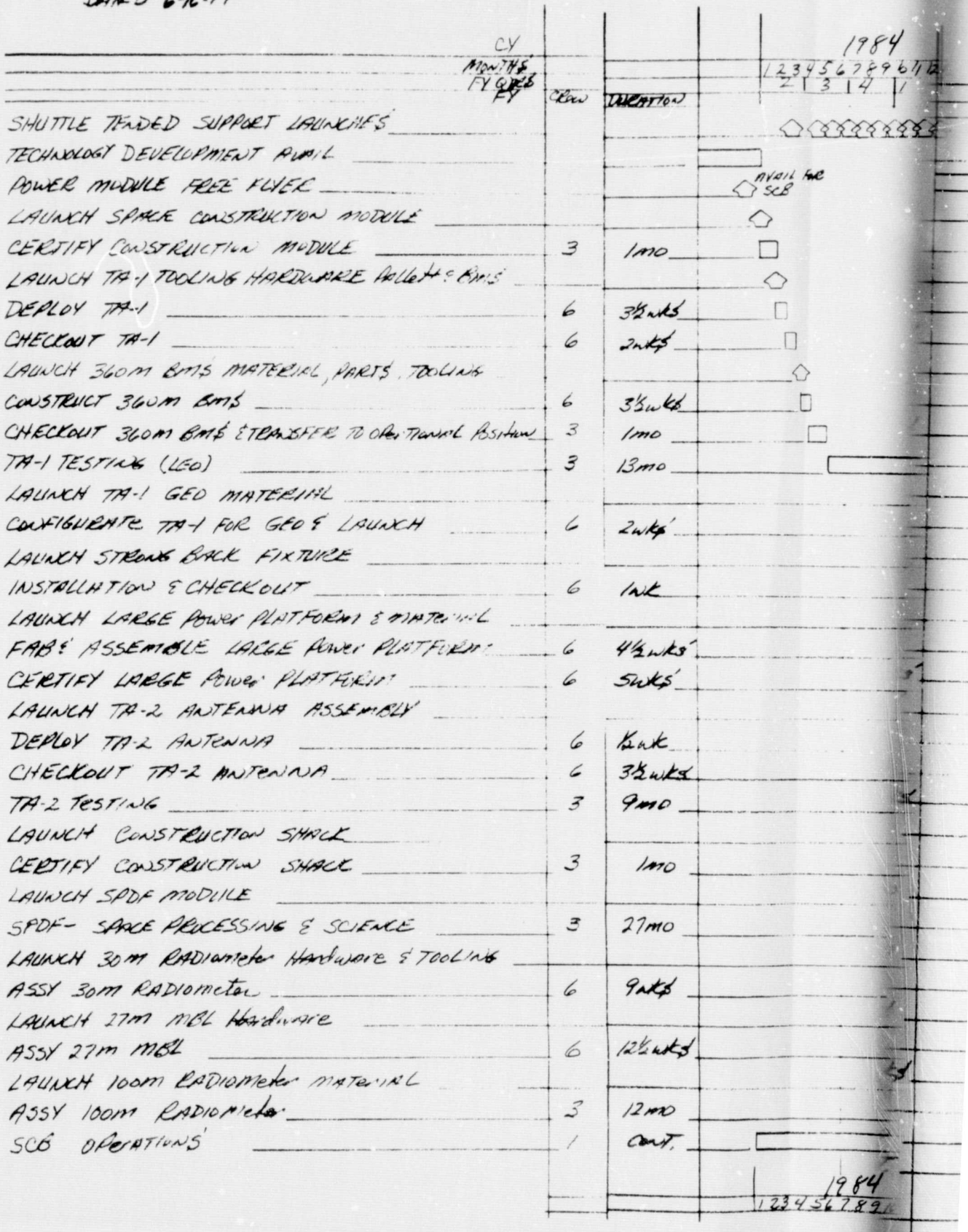
Figure 5-1. SCB Program Schedule (Typical 1)

CR60


1984
1985
1986
1987
1988
MAIN FOR SCB
SPACE PROCESSING
SPACE PROCESSING
SCIENCE
1984
1985
1986
1987

FOLDOUT FRAME 1

DATED 6-16-77



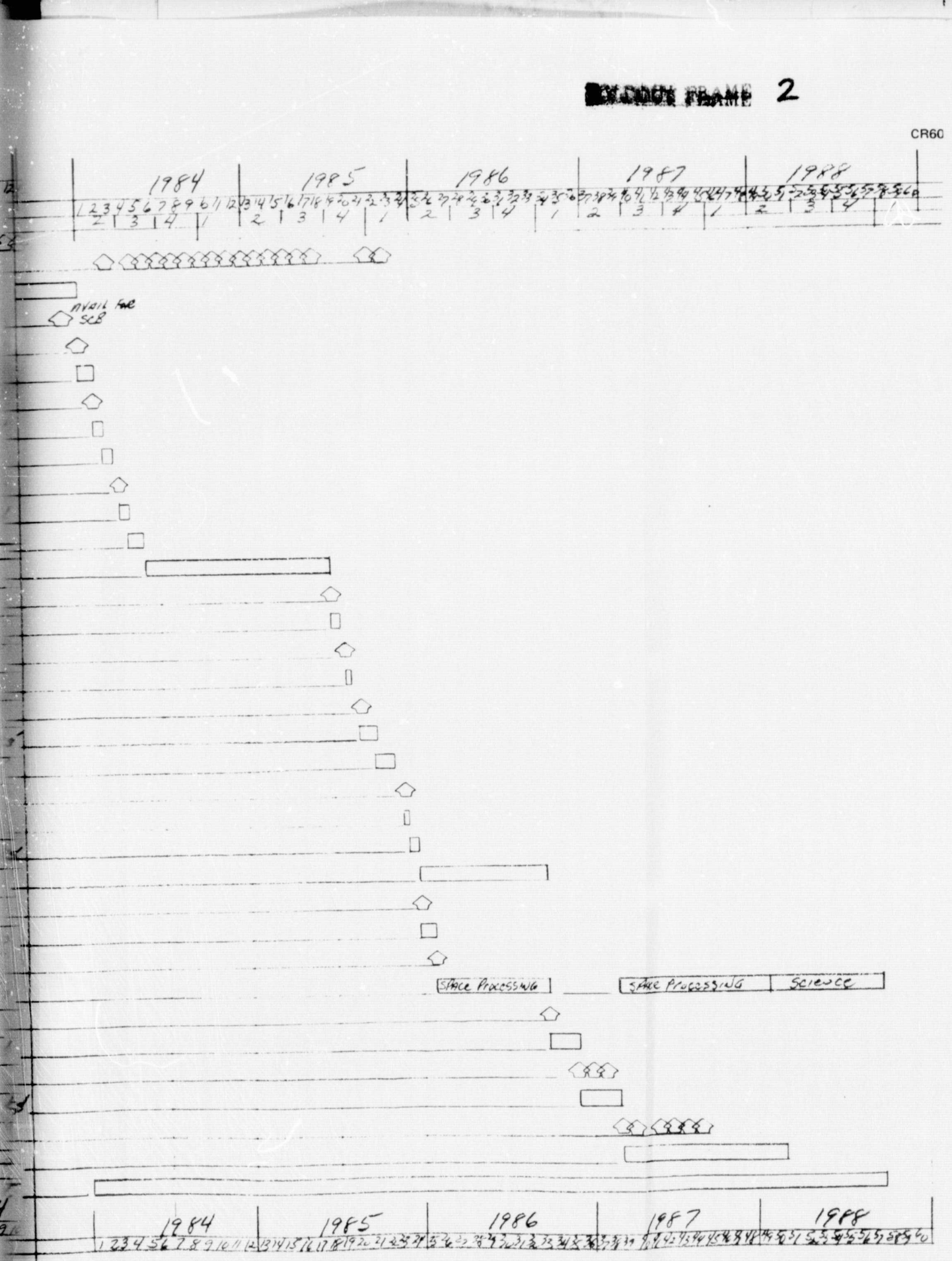


Figure 5-2. SCB Program Schedule (Typical 2)

- Best usage of EVA time resulted in a two 10 hour shift operation including 6 hours per shift of actual EVA time.
- The Typical Program ends fiscal year 1988 but contains the capability and flexibility for continuing.

The difference Between Typical 1 and Typical 2 schedules is:

- Construction Shack on Typical 2 is launched at a later time which results in approximately two years of Shuttle-Tended operations. This adds 17 additional launches until the Construction Shack is available.
- The Spacelab is not shown on Typical 2 schedule because the Construction Shack is launched only 30 days prior to the SPDF Processing and Science Module which has greater capability. In Typical 1 schedule Spacelab is operated, during the period prior to SPEDF being available, in a mode attached to the Construction Shack.

Section 6

DETAIL COST ESTIMATE AND FUNDING DISTRIBUTION

This section contains the top level funding distribution for the typical schedules discussed in Section 5, and the detail cost and funding distribution on NASA Form A and C respectively.

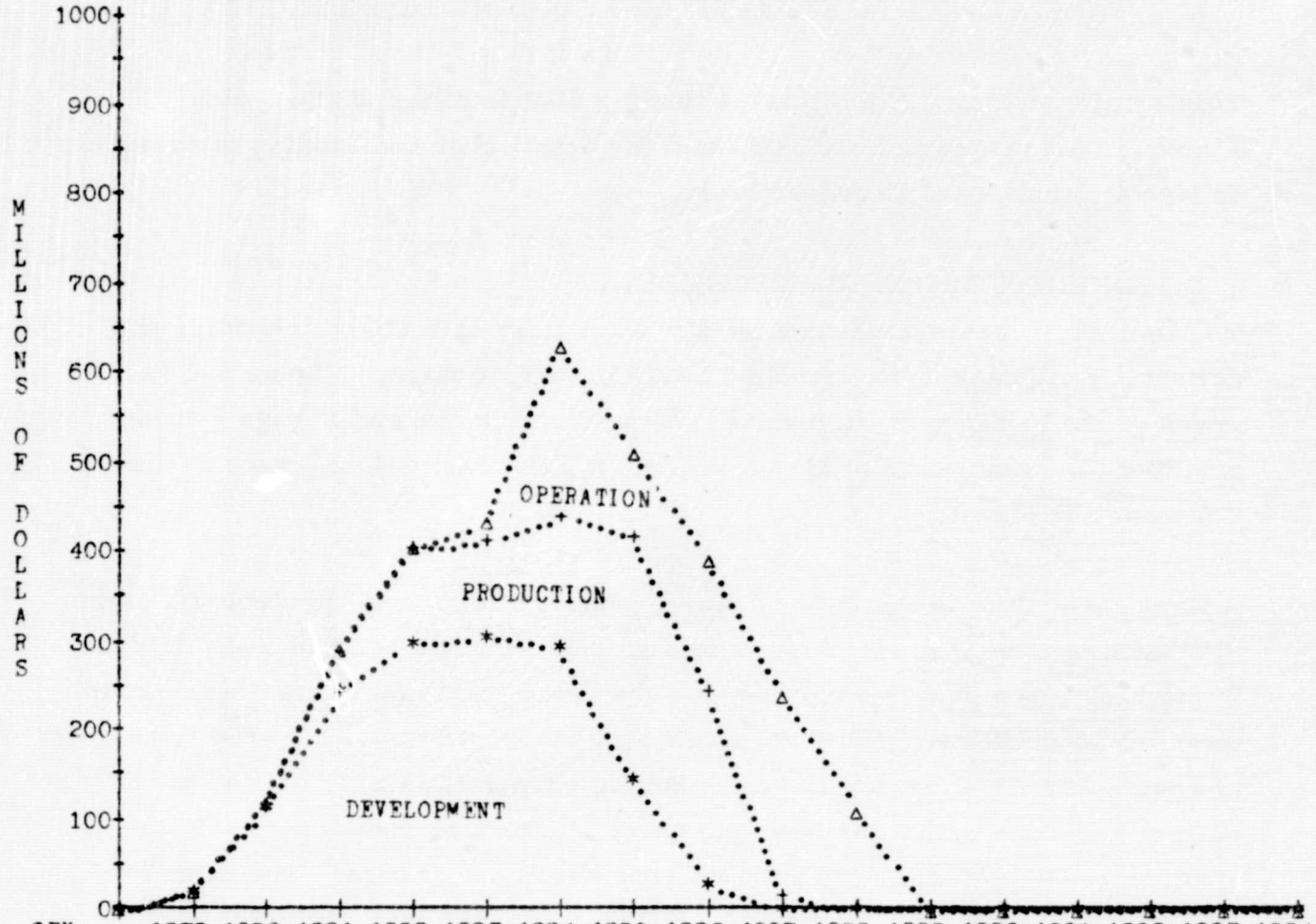
6.1 FUNDING FOR TYPICAL SCHEDULES

The typical program developed in this Part III of this study schedules the Construction Shack to be launched early in the program. Figure 6-1 is a graph of the total program annual funding distribution and Figure 6-2 is a graph of the cumulative program funding for the early deployment of the Construction Shack.

A first cut look at the cost and funding impact of delaying the deployment of the Construction Shack two years is shown in Figures 6-3 and 6-4. In deriving this estimate it was assumed that the delay in producing the Shack hardware would shift the funding requirements but would not change the total cost of shack. The funding for the engineering support was also shifted to reflect a change in the duration and level of effort of these costs. It was similarly assumed the total support cost would not change. The increase in total program cost from $3,150 million to $3,456 million reflects the 16 additional logistics flights required to support the crew directly from the Orbiter.

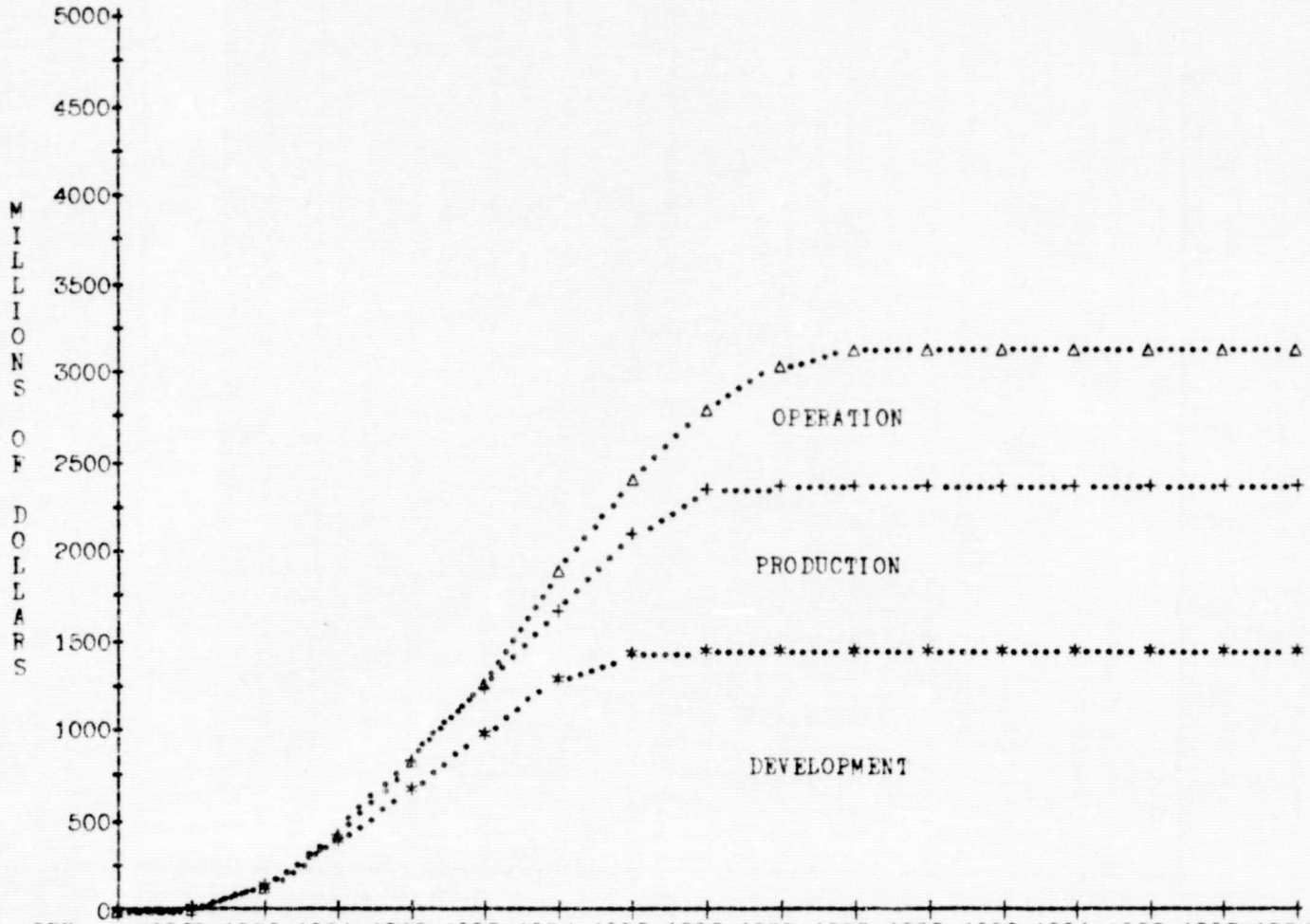
(Note: Only 16 additional flights are required since the Spacelab launch became the other logistic flight.)

Comparing the two annual funding curves, delaying the Construction Shack for two years provides a total funding decrease of $171 million or 20 percent during the first 4 years of the program. After 4 years the annual funding increases and early in 1984 the total program cost becomes greater and grows to a total increase of $306 million by the end of the program.



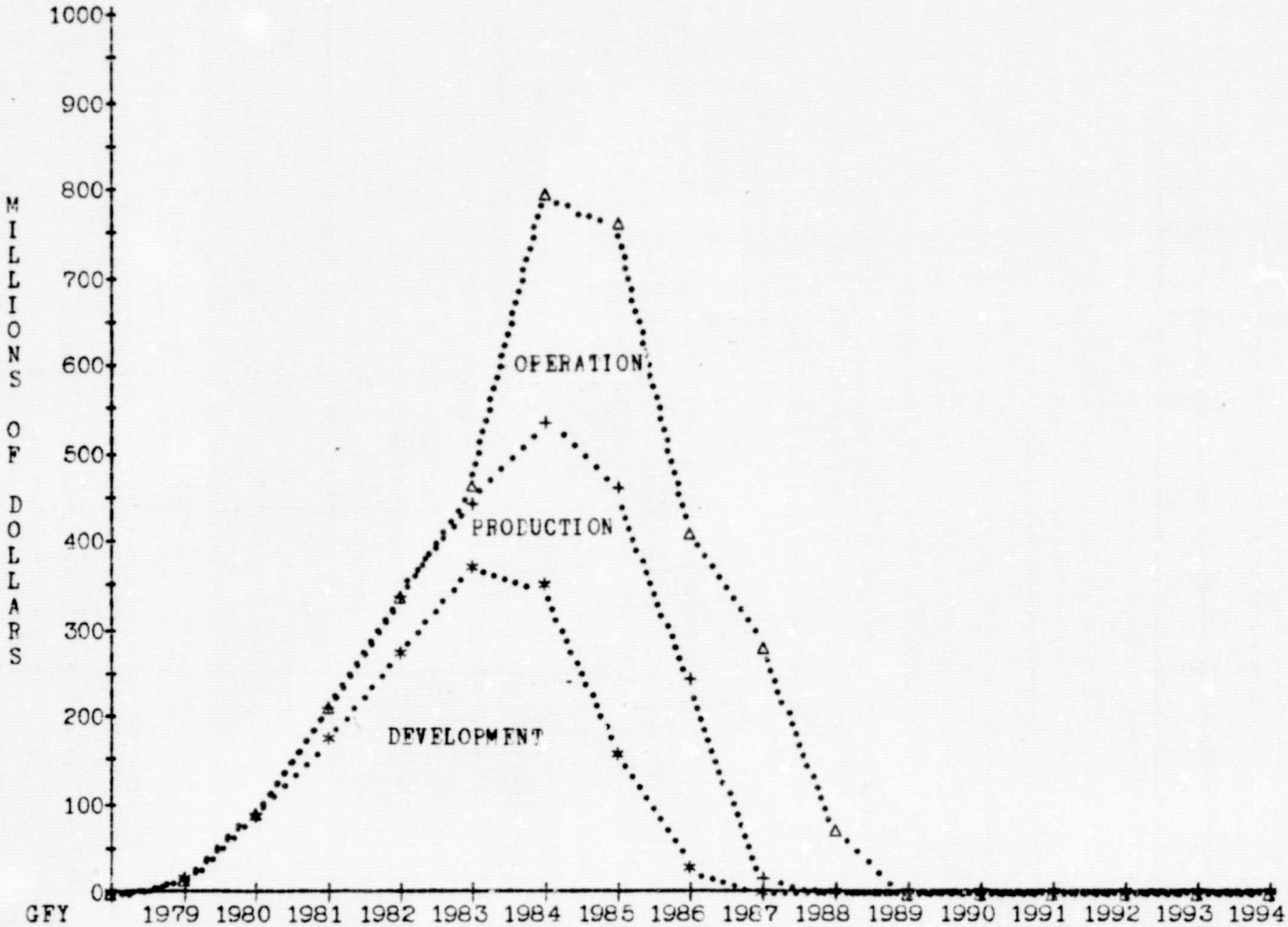
GFY	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDT•E	19	115	246	299	308	295	147	27	0	0	0	0	0	0	0	0
PROD	0	3	42	105	105	145	271	217	16	0	0	0	0	0	0	0
OPER	0	0	0	0	21	188	93	150	226	112	0	0	0	0	0	0
TOTAL	19	118	288	404	434	628	511	394	243	112	0	0	0	0	0	0

Figure 6-1. Typical 1 Construction Shack Early Annual Funding



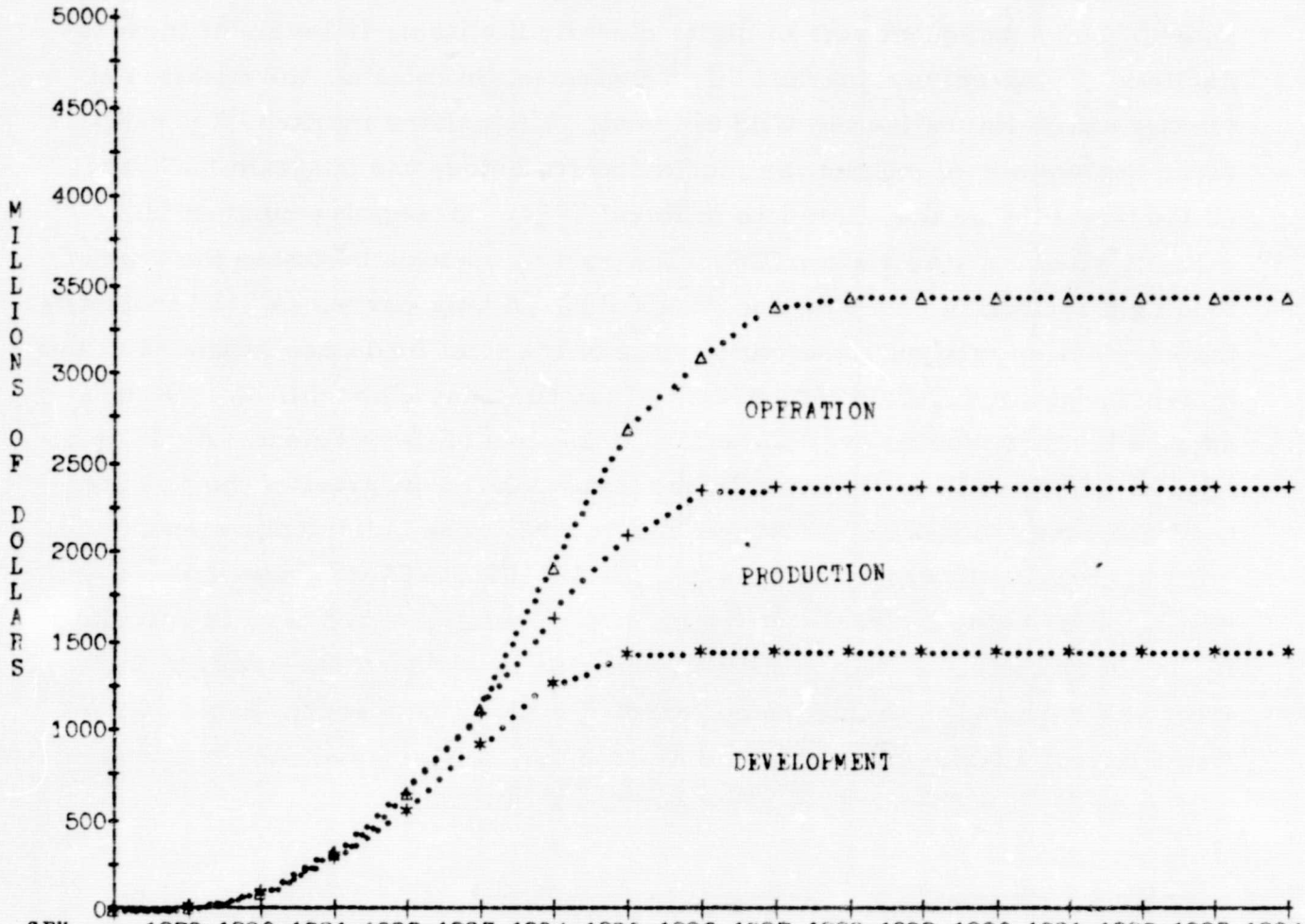
GFY	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDT•E	19	135	380	680	987	1282	1429	1456	1457	1457	1457	1457	1457	1457	1457	1457
PROD	0	3	45	150	255	401	671	838	904	904	904	904	904	904	904	904
OPER	0	0	0	0	21	210	302	452	678	790	790	790	790	790	790	790
TOTAL	19	138	426	830	1264	1892	2403	2796	3039	3150	3150	3150	3150	3150	3150	3150

Figure 6-2. Typical 1 Construction Shack Early Cumulative Funding



GFY	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDT•E	17	88	174	273	371	349	158	27	0	0	0	0	0	0	0	0
PROD	0	3	37	68	74	184	304	218	16	0	0	0	0	0	0	0
OPER	0	0	0	0	21	265	303	169	265	74	0	0	0	0	0	0
TOTAL	17	90	211	340	467	798	764	414	281	74	0	0	0	0	0	0

Figure 6-3. Typical 2 – Construction Shack Late Annual Funding



GFY	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDT•E	17	104	279	551	922	1272	1429	1456	1457	1457	1457	1457	1457	1457	1457	1457
PROD	0	3	40	108	182	366	670	888	904	904	904	904	904	904	904	904
OPER	0	0	0	0	21	286	589	758	1022	1096	1096	1096	1096	1096	1096	1096
TOTAL	17	107	318	659	1125	1923	2688	3102	3383	3456	3456	3456	3456	3456	3456	3456

Figure 6-4. Typical 2 – Construction Shack Late Cumulative Funding

6.2 DETAIL COST ESTIMATE

Table 6-1 is a computer printout of NASA Form A. It lists the costs of each WBS element by phase for the development, production and operations portions of the program. The identification number is the standard NASA configuration where the first two digits indicate the phase represented by the item. A "10-" denotes the sum of all three phases; an "11-" denotes the development phase; a "12-," the production phase; a "13-," the operational phase. The subsequent sets of digits classify the items in levels of increasing detail. The column marked "T_D" indicates, in months, the duration of funding expenditures for the WBS element. The column marked "T_S" indicates the number of months the funding starts before the program IOC date (1 January 1984 or the 4th month of fiscal 1984). A negative number indicates the funding starts after IOC. The spread function indicates the type of funding distribution based on the standard NASA beta curve. A "60" indicates the curve is skewed such that 60 percent of the total funds are expended at the mid-point of the schedule (50 percent of the time has elapsed). An "0" indicates a level of funding over the entire time span of the element. A "1" is a special MDAC code indicating a linear buildup from the start of the funding until the constant level of effort funding occurs. The buildup duration for WBS 11-100-30-01 was 21 months and for 12-100-30-01 was nine months. The learning index indicates the slope of the learning curve used in calculating quantity costs. In this study only one unit of any element itemized in the WBS was required. Therefore no learning curve was needed. Some of the items have multiple units for some of its detail components. When this was encountered, a 90 percent learning curve was utilized.

6.3 FUNDING DISTRIBUTION

Table 6-2 is the estimated annual funding distribution documented on NASA Form C. The WBS number is the standard NASA configuration. The columns show the annual funding estimate for the fiscal year indicated the top of the column.

Table 6-1 (Page 1 of 8)

DETAIL COST ESTIMATE

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR
CONTRACT NO.: NAS9-14958

COST DATA FORM - A(1)
NON-RECURRING (DUT-E)

DATE: JUNE 29, 1977
PAGE OF

IDENTIFICATION NUMBER	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	T D	T S	SPREAD FUNCT.
10-000-00-00-00-00-00-00	TOTAL PROGRAM	3	3150,41	117	63	
11- 0-00-00-00-00-00-00	TOTAL	3	1456,51	102	63	58
11- 50-00-00-00-00-00-00	MANAGEMENT INTEG	3	7,14	102	63	0
11-100-00-00-00-00-00-00	SPACE CONSTR BASE	3	493,05	78	63	55
11-100-10-00-00-00-00-00	CONSTRUCTION SYS	4	167,81	66	51	60
11-100-10-01-00-00-00-00	SPACE CONST MODUL	5	69,08	45	51	60
11-100-10-01-01-00-00-00	SUBSYSTEM INTEG	6	0,00	0	0	0
11-100-10-01-02-00-00-00	STRUCTURE/MECH	6	33,33	45	51	60
11-100-10-01-03-00-00-00	EC/LS	6	26,82	45	51	60
11-100-10-01-04-00-00-00	ELECT POWER	6	,82	45	51	60
11-100-10-01-05-00-00-00	CREW HABIT	6	0,00	0	0	0
11-100-10-01-06-00-00-00	PROPULSION RCS	6	0,00	0	0	0
11-100-10-01-07-00-00-00	GUIDANCE + CONTRO	6	0,00	0	0	0
11-100-10-01-08-00-00-00	INFORMATION	6	8,11	45	51	60
11-100-10-02-00-00-00-00	CRANE	5	75,00	45	51	60
11-100-10-03-00-00-00-00	CHERRY PICK PLAT	5	9,38	45	51	60
11-100-10-04-00-00-00-00	STNGBCK/TURNTABLE	5	14,36	45	30	60
11-100-20-00-00-00-00-00	SUPPORT SYSTEMS	4	194,48	58	63	60
11-100-20-01-00-00-00-00	POWER MODULE	5	28,06	45	63	60
11-100-20-01-01-00-00-00	SUBSYSTEM INTEG	6	0,00	0	0	0
11-100-20-01-02-00-00-00	STRUCTURE/MECH	6	14,19	45	63	60
11-100-20-01-03-00-00-00	EC/LS	6	2,50	45	63	60
11-100-20-01-04-00-00-00	ELECT POWER	6	21,45	45	63	60
11-100-20-01-05-00-00-00	FREE FLT SUPT SYS	6	19,92	45	63	60
11-100-20-01-06-00-00-00	PROPULSION/RCS	6	0,00	0	0	0
11-100-20-01-07-00-00-00	GUIDANCE + CONTRO	6	0,00	0	0	0
11-100-20-01-08-00-00-00	INFORMATION	6	0,00	0	0	0
11-100-20-02-00-00-00-00	CONSTRUCTION SHAC	5	96,42	45	50	60
11-100-20-02-01-00-00-00	SUBSYSTEM INTEG	6	0,00	0	0	0
11-100-20-02-02-00-00-00	STRUCTURE/MECH	6	9,15	45	50	60
11-100-20-02-03-00-00-00	EC/LS	6	35,75	45	50	60
11-100-20-02-04-00-00-00	ELECT POWER	6	,82	45	50	60
11-100-20-02-05-00-00-00	CREW HABIT	6	4,87	45	50	60
11-100-20-02-06-00-00-00	PROPULSION/RCS	6	0,00	0	0	0
11-100-20-02-07-00-00-00	GUIDANCE + CONTRO	6	17,45	45	50	60
11-100-20-02-08-00-00-00	INFORMATION	6	28,39	45	50	60
11-100-30-00-00-00-00-00	SCB ENGR SUPPORT	4	170,76	58	63	45
11-100-30-01-00-00-00-00	PROJECT MGMT	5	30,53	58	63	1
11-100-30-02-00-00-00-00	SYS ENGR + INTEG	5	27,07	58	63	60
11-100-30-03-00-00-00-00	GRND SUPT EQUIP	5	27,07	46	51	60
11-100-30-04-00-00-00-00	SYS TEST + EVAL	5	60,28	40	45	50

Table 6-1 (Page 2 of 8)

DETAIL COST ESTIMATE

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR
CONTRACT NO.: NAS9-14958

COST DATA FORM - A(1)
NON-RECURRING (DDT&E)

DATE: JUNE 29, 1977
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IDENTIFICATION NUMBER	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	T D	T S	SPREAD FUNCT.
11-100-30-05-00-00-00-00	FACILITIES	5	5,80	39	51	60
11-100-30-06-00-00-00-00	LOGISTICS (SPARES	5	0,00	0	0	0
11-100-30-07-00-00-00-00	LAUNCH OPNS	5	0,00	0	0	0
11-100-30-08-00-00-00-00	FLIGHT OPNS	5	0,00	0	0	0
11-200-00-00-00-00-00-00	TRANSP SYSTEMS	3	,00	0	0	0
11-200-10-00-00-00-00-00	SHUTTLE/SCB	4	0,00	0	0	0
11-200-20-00-00-00-00-00	SHUTTLE/MISSION H	4	0,00	0	0	0
11-200-30-00-00-00-00-00	SHUTTLE/LOG SUPPT	4	0,00	0	0	0
11-300-00-00-00-00-00-00	MISSION HARDWARE	3	956,31	83	49	60
11-300-10-00-00-00-00-00	SPACE POWER SYS	4	465,36	68	49	60
11-300-10-01-00-00-00-00	POWER PLATFORM	5	94,84	45	29	60
11-300-10-01-01-00-00-00	PWR PLT HARDWARE	6	42,94	45	29	60
11-300-10-01-02-00-00-00	PWR PLT ENGR SUPP	6	33,23	45	29	60
11-300-10-01-03-00-00-00	PWR PLT TOOLING	6	18,63	45	29	60
11-300-10-01-03-01-00-00	COMP BEAM FAB UNI	7	,00	0	0	0
11-300-10-01-03-07-00-00	RCS PACKAGE	7	18,63	45	29	60
11-300-10-02-00-00-00-00	TA-1 ANTENNA	5	184,51	63	49	60
11-300-10-02-01-00-00-00	TA-1 ANTENNA-HARD	6	18,42	45	49	60
11-300-10-02-02-00-00-00	TA-1ENGR SUPPORT	6	10,18	45	49	60
11-300-10-02-03-00-00-00	TA-1TOOLING	6	18,37	45	49	60
11-300-10-02-03-03-00-00	TA-1 PALLET	7	18,37	45	49	60
11-300-10-02-04-00-00-00	FREE FLT SUPT SS	6	137,54	45	31	60
11-300-10-03-00-00-00-00	TA-2 ANTENNA	5	108,54	45	26	60
11-300-10-03-01-00-00-00	TA-2 ANTENNA-HARD	6	68,61	45	26	60
11-300-10-03-02-00-00-00	TA-2ENGR SUPPORT	6	28,30	45	26	60
11-300-10-03-03-00-00-00	TA-2TOOLING	6	11,63	45	26	60
11-300-10-03-03-04-00-00	TA-2 PALLET	7	11,63	45	26	60
11-300-10-04-00-00-00-00	BMS-SMALL	5	16,36	45	49	60
11-300-10-04-01-00-00-00	BMS-SML-HARDWARE	6	12,00	45	49	60
11-300-10-04-02-00-00-00	BMS-SML ENGR SUPP	6	4,36	45	49	60
11-300-10-05-00-00-00-00	BMS-360	5	61,10	45	46	60
11-300-10-05-01-00-00-00	BMS-360-HARDWARE	6	14,95	45	46	60
11-300-10-05-02-00-00-00	BMS-360 ENGR SUPP	6	8,46	45	46	60
11-300-10-05-03-00-00-00	BMS-360 TOOLING	6	,00	0	0	0
11-300-10-05-03-01-00-00	COMP BEAM FAB UNI	7	,00	0	0	0
11-300-10-05-03-03-00-00	TA-1 PALLET	7	,00	0	0	0
11-300-10-05-04-00-00-00	FREE FLT SUPT SS	6	37,69	45	46	60
11-300-20-00-00-00-00-00	EARTH SERVICES	4	391,91	50	16	60
11-300-20-01-00-00-00-00	30M RADIOMETER	5	127,75	45	16	60

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DETAIL COST ESTIMATE

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR
CONTRACT NO,: NAS9-14958

COST DATA FORM - A(1)
NON-RECURRING (DDT-E)

DATE: JUNE 29, 1977
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IDENTIFICATION NUMBER	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	T D	T S	SPREAD FUNCT.
11-300-20-01-01-00-00-00	30MR HARDWARE	6	48,30	45	16	60
11-300-20-01-02-00-00-00	30MR ENGR SUPPOR	6	28,17	45	16	60
11-300-20-01-03-00-00-00	30MR TOOLING	6	,00	0	0	0
11-300-20-01-03-03-00-00	TA-1 PALLET	7	,00	0	0	0
11-300-20-01-03-06-00-00	STRONGBACK EXT,	7	,00	0	0	0
11-300-20-01-03-07-00-00	RCS PACKAGE	7	,00	0	0	0
11-300-20-01-04-00-00-00	FREE FLT SUPT SS	6	51,28	45	16	60
11-300-20-02-00-00-00-00	100M RADIOMETER	5	140,46	45	11	60
11-300-20-02-01-00-00-00	100MR HARDWARE	6	21,85	45	11	60
11-300-20-02-02-00-00-00	100MR ENGR SUPPOR	6	29,47	45	11	60
11-300-20-02-03-00-00-00	100MR TOOLING	6	6,54	45	11	60
11-300-20-02-03-06-00-00	STRONGBACK EXT,	7	6,54	45	11	60
11-300-20-02-03-07-00-00	RCS PACKAGE	7	,00	0	0	0
11-300-20-02-04-00-00-00	FREE FLT SUPT SS	6	82,60	45	11	60
11-300-20-03-00-00-00-00	27M MBL	5	123,69	45	14	60
11-300-20-03-01-00-00-00	27MBL HARDWARE	6	14,03	45	14	60
11-300-20-03-02-00-00-00	27MBL ENGR SUPPOR	6	27,06	45	14	60
11-300-20-03-03-00-00-00	27MBL TOOLING	6	0,00	0	0	0
11-300-20-03-04-00-00-00	FREE FLT SUPT SS	6	82,60	45	14	60
11-300-30-00-00-00-00-00	SPACE PROCESSING	4	99,05	45	25	60
11-300-30-01-00-00-00-00	SPACELAB	5	0,00	0	0	0
11-300-30-02-00-00-00-00	SPEDF	5	99,05	45	25	60
11-300-30-02-01-00-00-00	SPEDF-HARD	6	64,95	45	25	60
11-300-30-02-02-00-00-00	SPEDF ENG SUP	6	34,10	45	25	60

Table 6-1 (Page 4 of 8)

DETAIL COST ESTIMATE

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR
CONTRACT NO.: NAS9-14958

COST DATA FORM - A(2)
RECURRING (PRODUCTION)

DATE: JUNE 29, 1977
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IDENTIFICATION NUMBER	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	1ST UNIT COST T1	T D	T S	SPREAD FUNCT.	LEARN INDEX
12- 0-00-00-00-00-00-00	TOTAL	3	1.0	903.88	903.88	89	44	49	100
12- 50-00-00-00-00-00-00	MANAGEMENT INTEG	3	1.0	10.33	10.33	89	44	0	100
12-100-00-00-00-00-00-00	SPACE CONSTR BASE	3	1.0	192.21	192.21	65	44	45	100
12-100-10-00-00-00-00-00	CONSTRUCTION SYS	4	1.0	35.57	35.57	53	32	50	100
12-100-10-01-00-00-00-00	SPACE CONST MODUL	5	1.0	19.11	19.11	32	32	50	100
12-100-10-01-01-00-00-00	SUBSYSTEM INTEG	6	1.0	1.74	1.74	32	32	50	100
12-100-10-01-02-00-00-00	STRUCTURE/MECH	6	1.0	7.68	7.68	32	32	50	100
12-100-10-01-03-00-00-00	EC/LS	6	1.0	5.38	5.38	32	32	50	100
12-100-10-01-04-00-00-00	ELECT POWER	6	1.0	.27	.27	32	32	50	100
12-100-10-01-05-00-00-00	CREW HABIT	6	0.0	0.00	0.00	0	0	0	100
12-100-10-01-06-00-00-00	PROPULSION RCS	6	0.0	0.00	0.00	0	0	0	100
12-100-10-01-07-00-00-00	GUIDANCE + CONTRO	6	0.0	0.00	0.00	0	0	0	100
12-100-10-01-08-00-00-00	INFORMATION	6	1.0	4.05	4.05	32	32	50	100
12-100-10-02-00-00-00-00	CRANE	5	1.0	13.75	13.75	32	32	50	100
12-100-10-03-00-00-00-00	CHERRY PICK PLAT	5	1.0	.93	.93	32	32	50	100
12-100-10-04-00-00-00-00	STNGBCK/TURNTABLE	5	1.0	1.77	1.77	32	11	50	100
12-100-20-00-00-00-00-00	SUPPORT SYSTEMS	4	1.0	122.53	122.53	45	44	50	100
12-100-20-01-00-00-00-00	POWER MODULE	5	1.0	56.72	56.72	32	44	50	100
12-100-20-01-01-00-00-00	SUBSYSTEM INTEG	6	1.0	5.16	5.16	32	44	50	100
12-100-20-01-02-00-00-00	STRUCTURE/MECH	6	1.0	1.86	1.86	32	44	50	100
12-100-20-01-03-00-00-00	EC/LS	6	1.0	.50	.50	32	44	50	100
12-100-20-01-04-00-00-00	ELECT POWER	6	1.0	38.07	38.07	32	44	50	100
12-100-20-01-05-00-00-00	FREE FLT SUPT SYS	6	1.0	11.13	11.13	32	44	50	100
12-100-20-01-06-00-00-00	PROPULSION/RCS	6	0.0	0.00	0.00	0	0	0	100
12-100-20-01-07-00-00-00	GUIDANCE + CONTRO	6	0.0	0.00	0.00	0	0	0	100
12-100-20-01-08-00-00-00	INFORMATION	6	0.0	0.00	0.00	0	0	0	100
12-100-20-02-00-00-00-00	CONSTRUCTION SHAC	5	1.0	65.82	65.82	32	31	50	100
12-100-20-02-01-00-00-00	SUBSYSTEM INTEG	6	1.0	5.98	5.98	32	31	50	100
12-100-20-02-02-00-00-00	STRUCTURE/MECH	6	1.0	12.95	12.95	32	31	50	100
12-100-20-02-03-00-00-00	EC/LS	6	1.0	15.06	15.06	32	31	50	100
12-100-20-02-04-00-00-00	ELECT POWER	6	1.0	.27	.27	32	31	50	100
12-100-20-02-05-00-00-00	CREW HABIT	6	1.0	2.18	2.18	32	31	50	100
12-100-20-02-06-00-00-00	PROPULSION/RCS	6	0.0	0.00	0.00	0	0	0	100
12-100-20-02-07-00-00-00	GUIDANCE + CONTRO	6	1.0	7.94	7.94	32	31	50	100
12-100-20-02-08-00-00-00	INFORMATION	6	1.0	21.45	21.45	32	31	50	100
12-100-30-00-00-00-00-00	SCB ENGR SUPPORT	4	1.0	34.11	34.11	45	44	22	100
12-100-30-01-00-00-00-00	PROJECT MGMT	5	1.0	19.22	19.22	45	44	1	100
12-100-30-02-00-00-00-00	SYS ENGR + INTEG	5	1.0	14.89	14.89	45	44	50	100
12-100-30-03-00-00-00-00	GRND SUPT EQUIP	5	0.0	0.00	0.00	0	0	0	100
12-100-30-05-00-00-00-00	FACILITIES	5	0.0	0.00	0.00	0	0	0	100

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DETAIL COST ESTIMATE

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR
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COST DATA FORM - A(2)
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IDENTIFICATION NUMBER	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	1ST UNIT COST T1	T D	T S	SPREAD FUNCT.	LEARN INDEX
12-100-30-06-00-00-00	LOGISTICS (SPARES	5	0.0	0.00	0.00	0	0	0	100
12-200-00-00-00-00-00	TRANSP SYSTEMS	3	1.0	.00	.00	0	0	0	100
12-200-10-00-00-00-00	SHUTTLE/SCR	4	0.0	0.00	0.00	0	0	0	100
12-200-20-00-00-00-00	SHUTTLE/MISSION H	4	0.0	0.00	0.00	0	0	0	100
12-200-30-00-00-00-00	SHUTTLE/LCG SUPPT	4	0.0	0.00	0.00	0	0	0	100
12-300-00-00-00-00-00	MISSION HARDWARE	3	1.0	701.34	701.34	70	30	50	100
12-300-10-00-00-00-00	SPACE POWER SYS	4	1.0	229.64	229.64	55	30	50	100
12-300-10-01-00-00-00	POWER PLATFORM	5	1.0	70.72	70.72	32	10	50	100
12-300-10-01-01-00-00	PWR PLT HARDWARE	6	1.0	48.62	48.62	32	10	50	100
12-300-10-01-02-00-00	PWR PLT ENGR SUPP	6	1.0	13.96	13.96	32	10	50	100
12-300-10-01-03-00-00	PWR PLT TOOLING	6	1.0	8.14	8.14	32	10	50	100
12-300-10-01-03-01-00	COMP BEAM FAB UNI	7	0.0	0.00	0.00	0	0	0	100
12-300-10-01-03-02-00	STNGBCK/TURNTABLE	7	0.0	0.00	0.00	0	0	0	100
12-300-10-01-03-07-00	RCS PACKAGE	7	1.0	8.14	8.14	32	10	50	100
12-300-10-02-00-00-00	TA-1 ANTENNA	5	1.0	101.25	101.25	50	30	50	100
12-300-10-02-01-00-00	TA-1 ANTENNA-HARD	6	1.0	10.96	10.96	32	30	50	100
12-300-10-02-02-00-00	TA-1ENGR SUPPORT	6	1.0	3.15	3.15	32	30	50	100
12-300-10-02-03-00-00	TA-1TOOLING	6	1.0	1.01	1.01	32	30	50	100
12-300-10-02-03-03-00	TA-1 PALLET	7	1.0	1.01	1.01	32	30	50	100
12-300-10-02-03-08-00	IUS	7	0.0	0.00	0.00	0	0	0	100
12-300-10-02-04-00-00	FREE FLT SUPT SS	6	1.0	86.15	86.15	32	12	50	100
12-300-10-03-00-00-00	TA-2 ANTENNA	5	1.0	23.47	23.47	32	7	50	100
12-300-10-03-01-00-00	TA-2 ANTENNA-HARD	6	1.0	17.51	17.51	32	7	50	100
12-300-10-03-02-00-00	TA-2ENGR SUPPORT	6	1.0	5.03	5.03	32	7	50	100
12-300-10-03-03-00-00	TA-2TOOLING	6	1.0	.93	.93	32	7	50	100
12-300-10-03-03-04-00	TA-2 PALLET	7	1.0	.93	.93	32	7	50	100
12-300-10-04-00-00-00	BMS-SMALL	5	1.0	2.12	2.12	32	30	50	100
12-300-10-04-01-00-00	BMS-SML-HARDWARE	6	1.0	1.65	1.65	32	30	50	100
12-300-10-04-02-00-00	BMS-SML ENGR SUPP	6	1.0	.47	.47	32	30	50	100
12-300-10-05-00-00-00	BMS-360	5	1.0	32.07	32.07	32	27	50	100
12-300-10-05-01-00-00	BMS-360-HARDWARE	6	1.0	9.37	9.37	32	27	50	100
12-300-10-05-02-00-00	BMS-360 ENGR SUPP	6	1.0	2.69	2.69	32	27	50	100
12-300-10-05-03-00-00	BMS-360 TOOLING	6	0.0	0.00	0.00	0	0	0	100
12-300-10-05-03-01-00	COMP BEAM FAB UNI	7	0.0	0.00	0.00	0	0	0	100
12-300-10-05-03-03-00	TA-1 PALLET	7	0.0	0.00	0.00	0	0	0	100
12-300-10-05-04-00-00	FREE FLT SUPT SS	6	1.0	20.00	20.00	32	27	50	100
12-300-20-00-00-00-00	EARTH SERVICES	4	1.0	427.60	427.60	37	3	50	100
12-300-20-01-00-00-00	30M RADIOMETER	5	1.0	111.93	111.93	32	3	50	100
12-300-20-01-01-00-00	30MR HARDWARE	6	1.0	32.30	32.30	32	3	50	100
12-300-20-01-02-00-00	30MR ENGR SUPPOR	6	1.0	9.27	9.27	32	3	50	100
12-300-20-01-03-00-00	30MR TOOLING	6	0.0	0.00	0.00	0	0	0	100
12-300-20-01-03-03-00	TA-1 PALLET	7	0.0	0.00	0.00	0	0	0	100
12-300-20-01-03-06-00	STRONGBACK EXT.	7	0.0	0.00	0.00	0	0	0	100

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DETAIL COST ESTIMATE

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR
CONTRACT NO.: NAS9-14958

COST DATA FORM - A(2)
RECURRING (PRODUCTION)

DATE: JUNE 29, 1977
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IDENTIFICATION NUMBER	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	1ST UNIT COST T1	T D	T S	SPREAD FUNCT.	LEARN INDEX
12-300-20-01-03-07-00-00	RCS PACKAGE	7	0.0	0.00	0.00	0	0	0	100
12-300-20-01-04-00-00-00	FREE FLT SUPT SS	6	1.0	70.36	70.36	32	-3	50	100
12-300-20-02-00-00-00-00	100M RADIOMETER	5	1.0	158.69	158.69	32	-8	50	100
12-300-20-02-01-00-00-00	100MR HARDWARE	6	1.0	55.07	55.07	32	-8	50	100
12-300-20-02-02-00-00-00	100MR ENGR SUPPOR	6	1.0	15.81	15.81	32	-8	50	100
12-300-20-02-03-00-00-00	100MR TOOLING	6	1.0	1.67	1.67	32	-8	50	100
12-300-20-02-03-02-00-00	STNGBCK/TURNTABLE	7	0.0	0.00	0.00	0	0	0	100
12-300-20-02-03-06-00-00	STRONGBACK EXT.	7	1.0	1.67	1.67	32	-8	50	100
12-300-20-02-03-07-00-00	RCS PACKAGE	7	0.0	0.00	0.00	0	0	0	100
12-300-20-02-04-00-00-00	FREE FLT SUPT SS	6	1.0	86.15	86.15	32	-8	50	100
12-300-20-03-00-00-00-00	27M MBL	5	1.0	156.98	156.98	32	-5	50	100
12-300-20-03-01-00-00-00	27MBL HARDWARE	6	1.0	55.03	55.03	32	-5	50	100
12-300-20-03-02-00-00-00	27MBL ENGR SUPPOR	6	1.0	15.80	15.80	32	-5	50	100
12-300-20-03-03-00-00-00	27MBL TOOLING	6	0.0	0.00	0.00	0	0	0	100
12-300-20-03-04-00-00-00	FREE FLT SUPT SS	6	1.0	86.15	86.15	32	-5	50	100
12-300-30-00-00-00-00-00	SPACE PROCESSING	4	1.0	44.10	44.10	32	6	50	100
12-300-30-01-00-00-00-00	SPACELAB	5	0.0	0.00	0.00	0	0	0	100
12-300-30-02-00-00-00-00	SPEDF	5	1.0	44.10	44.10	32	6	50	100
12-300-30-02-01-00-00-00	SPEDF-HARD	6	1.0	34.27	34.27	32	6	50	100
12-300-30-02-02-00-00-00	SPEDF ENG SUP	6	1.0	9.84	9.84	32	6	50	100

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DETAIL COST ESTIMATE

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR
CONTRACT NO.: NAS9-14958

COST DATA FORM - A(3)
RECURRING (OPERATIONS)

DATE: JUNE 29, 1977
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IDENTIFICATION NUMBER	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	T D	T S	SPREAD FUNCT.	LEARN INDEX
13- 0-00-00-00-00-00-00	TOTAL	3	1.0	790.02	72	15	0	100
13- 50-00-00-00-00-00-00	MANAGEMENT INTEG.	3	1.0	.00	0	0	0	100
13-100-00-00-00-00-00	SPACE CONSTR BASE	3	1.0	388.92	72	15	0	100
13-100-10-00-00-00-00	CONSTRUCTION SYS	4	0.0	0.00	0	0	0	100
13-100-10-01-00-00-00	SPACE CONST MODUL	5	0.0	0.00	0	0	0	100
13-100-20-00-00-00-00	SUPPORT SYSTEMS	4	0.0	0.00	0	0	0	100
13-100-20-01-00-00-00	POWER MODULE	5	0.0	0.00	0	0	0	100
13-100-20-02-00-00-00	CONSTRUCTION SHAC	5	0.0	0.00	0	0	0	100
13-100-30-00-00-00-00	SCB ENGR SUPPORT	4	1.0	388.92	72	15	0	100
13-100-30-01-00-00-00	PROJECT MGMT	5	0.0	0.00	0	0	0	100
13-100-30-02-00-00-00	SYS ENGR + INTEG	5	0.0	0.00	0	0	0	100
13-100-30-03-00-00-00	GRND SUPT EQUIP	5	0.0	0.00	0	0	0	100
13-100-30-05-00-00-00	FACILITIES	5	0.0	0.00	0	0	0	100
13-100-30-06-00-00-00	LOGISTICS (SPARES	5	1.0	11.27	60	3	0	100
13-100-30-07-00-00-00	LAUNCH OPNS	5	1.0	61.00	72	15	0	100
13-100-30-08-00-00-00	FLIGHT OPNS	5	1.0	316.65	72	15	0	100
13-200-00-00-00-00-00	TRANSP SYSTEMS	3	1.0	401.10	48	1	0	100
13-200-10-00-00-00-00	SHUTTLE/SCB	4	1.0	76.40	23	1	0	100
13-200-10-01-00-00-00	POWER MODULE	5	1.0	19.10	1	1	0	100
13-200-10-02-00-00-00	CONSTR SHACK	5	1.0	19.10	1	-1	0	100
13-200-10-03-00-00-00	SPACE CONSTR MOD	5	1.0	19.10	1	0	0	100
13-200-10-04-00-00-00	STRONGBACK +	5	1.0	19.10	1	-21	0	100
13-200-20-00-00-00-00	SHUTTLE/MISSION H	4	1.0	324.70	45	-2	0	100
13-200-20-01-00-00-00	POWER PLATFORM	5	1.0	19.10	1	-22	0	100
13-200-20-02-00-00-00	TA-1 ANTENNA + BM	5	1.0	19.10	1	-2	0	100
13-200-20-03-00-00-00	TA-2 ANTENNA	5	1.0	19.10	1	-25	0	100
13-200-20-04-00-00-00	BMS 360	5	1.0	19.10	1	-5	0	100
13-200-20-05-00-00-00	30M RADIOMETER	5	1.0	19.10	1	-35	0	100
13-200-20-06-00-00-00	100M RADIOMETER	5	1.0	114.60	6	-41	0	100
13-200-20-07-00-00-00	27M MBL	5	1.0	57.30	3	-37	0	100
13-200-20-08-00-00-00	SPACELAB	5	1.0	19.10	1	-4	0	100
13-200-20-09-00-00-00	SP PROC DEVEL FAC	5	1.0	19.10	1	-26	0	100
13-200-20-10-00-00-00	TA-1 FREE FLT SS	5	1.0	19.10	1	-20	0	100
13-200-30-00-00-00-00	SHUTTLE/LOG SUPPT	4	0.0	0.00	0	0	0	100
13-200-30-01-00-00-00	LOG SUP-1984	5	0.0	0.00	0	0	0	100
13-200-30-02-00-00-00	LOG SUP-1985	5	0.0	0.00	0	0	0	100
13-200-30-03-00-00-00	LOG SUP-1986	5	0.0	0.00	0	0	0	100
13-200-30-04-00-00-00	LOG SUP-1987	5	0.0	0.00	0	0	0	100
13-200-30-05-00-00-00	LOG SUP-1988	5	0.0	0.00	0	0	0	100
13-200-30-06-00-00-00	LOG SUP-1989	5	0.0	0.00	0	0	0	100
13-300-00-00-00-00-00	MISSION HARDWARE	3	1.0	.00	0	0	0	100

Table 6-1 (Page 8 of 8)

DETAIL COST ESTIMATE

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR
CONTRACT NO.: NAS9-14958

COST DATA FORM - A(3)
RECURRING (OPERATIONS)

DATE: JUNE 29, 1977
PAGE OF

IDENTIFICATION NUMBER	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	T D	T S	SPREAD FUNCT.	LEARN INDEX
13-300-10-00-00-00-00-00	SPACE POWER SYS	4	0.0	0.00	0	0	0	100
13-300-10-01-00-00-00-00	POWER PLATFORM	5	0.0	0.00	0	0	0	100
13-300-10-01-01-00-00-00	PWR PLT HARDWARE	6	0.0	0.00	0	0	0	100
13-300-10-01-02-00-00-00	PWR PLT ENGR SUPP	6	0.0	0.00	0	0	0	100
13-300-10-01-03-00-00-00	PWR PLT TOOLING	6	0.0	0.00	0	0	0	100
13-300-10-02-00-00-00-00	TA-1 ANTENNA	5	0.0	0.00	0	0	0	100
13-300-10-02-01-00-00-00	TA-1 ANTENNA-HARD	6	0.0	0.00	0	0	0	100
13-300-10-02-02-00-00-00	TA-1ENGR SUPPORT	6	0.0	0.00	0	0	0	100
13-300-10-02-03-00-00-00	TA-1TOOLING	6	0.0	0.00	0	0	0	100
13-300-10-03-00-00-00-00	TA-2 ANTENNA	5	0.0	0.00	0	0	0	100
13-300-10-03-01-00-00-00	TA-2 ANTENNA-HARD	6	0.0	0.00	0	0	0	100
13-300-10-03-02-00-00-00	TA-2ENGR SUPPORT	6	0.0	0.00	0	0	0	100
13-300-10-03-03-00-00-00	TA-2TOOLING	6	0.0	0.00	0	0	0	100
13-300-10-04-00-00-00-00	BMS-SMALL	5	0.0	0.00	0	0	0	100
13-300-10-04-01-00-00-00	BMS-SML-HARDWARE	6	0.0	0.00	0	0	0	100
13-300-10-05-00-00-00-00	BMS-360	5	0.0	0.00	0	0	0	100
13-300-10-05-01-00-00-00	BMS-360-HARDWARE	6	0.0	0.00	0	0	0	100
13-300-10-05-03-00-00-00	BMS-360 TOOLING	6	0.0	0.00	0	0	0	100
13-300-20-00-00-00-00-00	EARTH SERVICES	4	0.0	0.00	0	0	0	100
13-300-20-01-00-00-00-00	30M RADIOMETER	5	0.0	0.00	0	0	0	100
13-300-20-01-01-00-00-00	30MR HARDWARE	6	0.0	0.00	0	0	0	100
13-300-20-01-02-00-00-00	30MR ENGR SUPPOR	6	0.0	0.00	0	0	0	100
13-300-20-01-03-00-00-00	30MR TOOLING	6	0.0	0.00	0	0	0	100
13-300-20-02-00-00-00-00	100M RADIOMETER	5	0.0	0.00	0	0	0	100
13-300-20-02-01-00-00-00	100MR HARDWARE	6	0.0	0.00	0	0	0	100
13-300-20-02-02-00-00-00	100MR ENGR SUPPOR	6	0.0	0.00	0	0	0	100
13-300-20-02-03-00-00-00	100MR TOOLING	6	0.0	0.00	0	0	0	100
13-300-20-03-00-00-00-00	27M MBL	5	0.0	0.00	0	0	0	100
13-300-20-03-01-00-00-00	27MBL HARDWARE	6	0.0	0.00	0	0	0	100
13-300-20-03-02-00-00-00	27MBL ENGR SUPPOR	6	0.0	0.00	0	0	0	100
13-300-20-03-03-00-00-00	27MBL TOOLING	6	0.0	0.00	0	0	0	100
13-300-30-00-00-00-00-00	SPACE PROCESSING	4	0.0	0.00	0	0	0	100
13-300-30-01-00-00-00-00	SPACELAB	5	0.0	0.00	0	0	0	100
13-300-30-02-00-00-00-00	SPEDF	5	0.0	0.00	0	0	0	100
13-300-30-02-01-00-00-00	SPEDF-HARD	6	0.0	0.00	0	0	0	100

Table 6-2 (Page 1 of 9)

FUNDING DISTRIBUTION

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR — FUNDING SCHEDULE — DATE: JUNE 29, 1977
CONTRACT NO: NAS9-14958 — DATA FORM C — PAGE: 1 HF

X NON RECURRING(DDT+E) — RECURRING(PRODUCTION) — RECURRING(OPERATIONS)

DOLLARS IN MILLIONS

WBS NUMBER	WBS NAME	TOTAL	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
10-000-00-00-00-00-00	TOTAL PROGRAM	3150.6	19.2	118.4	288.3	404.4	433.8	628.0	510.7	393.6	242.5	111.7	0.0	0.0
11-000-00-00-00-00-00	TOTAL DEVELOPT	1456.5	19.2	115.4	245.8	299.3	307.5	294.6	147.4	26.9	.4	0.0	0.0	0.0
11-050-00-00-00-00-00	MANAGEMENT INTE	7.1	.8	.8	.8	.8	.8	.8	.8	.8	.4	0.0	0.0	0.0
11-100-00-00-00-00-00	SPACE CONSTR BA	493.1	18.3	100.3	189.8	146.4	34.7	3.3	.2	0.0	0.0	0.0	0.0	0.0
11-100-10-00-00-00-00	CONSTRUCTION ST	167.8	0.0	32.5	68.2	50.9	12.7	3.3	.2	0.0	0.0	0.0	0.0	0.0
11-100-10-01-00-00-00	SPACE CONST MOD	69.1	0.0	14.6	30.6	21.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-01-01-00-00	SUBSYSTEM INTEG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-01-02-00-00	STRUCTURE/MECH	33.3	0.0	7.1	14.8	10.1	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-01-03-00-00	EC/LS	26.8	0.0	5.7	11.9	8.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-01-04-00-00	ELECT POWER	.8	0.0	.2	.4	.2	.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-01-05-00-00	CREW HABIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-01-06-00-00	PROPULSION/RCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-01-07-00-00	GUIDANCE + CONT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-01-08-00-00	INFORMATION	8.1	0.0	1.7	3.6	2.5	.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-02-00-00-00	CRANE	75.0	0.0	15.9	33.2	22.8	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-03-00-00-00	CHERRY PICK PLA	9.4	0.0	2.0	4.2	2.8	.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-10-04-00-00-00	STNGBCK/TURNTAB	14.4	0.0	0.0	.2	4.3	6.3	3.3	.2	0.0	0.0	0.0	0.0	0.0
11-100-20-00-00-00-00	SUPPORT SYSTEMS	154.5	12.3	43.1	59.9	33.9	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-01-00-00-00	POWER MODULE	58.1	12.3	25.7	17.6	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-01-01-00-00	SUBSYSTEM INTEG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-01-02-00-00	STRUCTURE/MECH	14.2	3.0	6.3	4.3	.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-01-03-00-00	EC/LS	2.5	.5	1.1	.8	.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-01-04-00-00	ELECT POWER	21.5	4.5	9.5	6.5	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-01-05-00-00	FREE FLT SUPT S	19.9	4.2	8.8	6.0	.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-01-06-00-00	PROPULSION/RCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-01-07-00-00	GUIDANCE + CONT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-01-08-00-00	INFORMATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-02-00-00-00	CONSTRUCTION SH	96.4	0.0	17.4	42.3	31.5	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-02-01-00-00	SUBSYSTEM INTEG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-02-02-00-00	STRUCTURE/MECH	9.1	0.0	1.6	4.0	3.0	.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-02-03-00-00	EC/LS	35.7	0.0	6.4	15.7	11.7	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-02-04-00-00	ELECT POWER	.8	0.0	.1	.4	.3	.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-02-05-00-00	CREW HABIT	4.9	0.0	.9	2.1	1.6	.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-02-06-00-00	PROPULSION/RCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-02-07-00-00	GUIDANCE + CONT	17.5	0.0	3.1	7.6	5.7	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-20-02-08-00-00	INFORMATION	28.4	0.0	5.1	12.4	9.3	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-30-00-00-00-00	SCB ENGR SUPPOR	170.8	6.1	24.8	61.7	61.6	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-30-01-00-00-00	PROJECT MGMT	30.5	2.5	6.9	7.5	7.5	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-30-02-00-00-00	SYS ENGR + INTE	27.1	3.6	8.7	9.0	5.1	.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-30-03-00-00-00	GRND SUPT EQUIP	27.1	0.0	5.5	11.7	8.4	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-30-04-00-00-00	SYS TEST + EVAL	80.3	0.0	2.1	30.5	30.3	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

FUNDING DISTRIBUTION

STUDY TITLE: PART 3 BASELINE, CS EARLY, 9YR
CONTRACT NO: NAS9-14958

FUNDING SCHEDULE
DATA FORM C

DATE: JUNE 29, 1977
PAGE: 2 OF

X NON RECURRING(DDT+E) | RECURRING(PRODUCTION) | RECURRING(OPERATIONS)

DOLLARS IN MILLIONS

WBS NUMBER	WBS NAME	TOTAL	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
11-100-30-05-00-00-00	FACILITIES	5.8	0.0	1.6	2.9	1.3	.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-30-06-00-00-00	LOGISTICS (SPAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-30-07-00-00-00	LAUNCH OPNS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-100-30-08-00-00-00	FLIGHT OPNS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-00-00-00-00-00	TRANSP SYSTEMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-10-00-00-00-00	SHUTTLE/SCB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-10-01-00-00-00	POWER MODULE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-10-02-00-00-00	CONSTR SHACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-10-03-00-00-00	SPACE CONSTR HD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-10-04-00-00-00	STRONGBACK *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-00-00-00-00	SHUTTLE/MISSION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-01-00-00-00	POWER PLATFORM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-02-00-00-00	TA-1 ANTENNA *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-03-00-00-00	TA-2 ANTENNA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-04-00-00-00	BMS 360	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-05-00-00-00	30M RADIOMETER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-06-00-00-00	100M RADIOMETER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-07-00-00-00	27M MBL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-08-00-00-00	SPACELAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-09-00-00-00	SP PROC DEVEL F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-20-10-00-00-00	TA-1 FREE FLT S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-30-00-00-00-00	SHUTTLE/LOG SUP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-30-01-00-00-00	LOG SUP-1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-30-02-00-00-00	LOG SUP-1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-30-03-00-00-00	LOG SUP-1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-30-04-00-00-00	LOG SUP-1987	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-30-05-00-00-00	LOG SUP-1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-200-30-06-00-00-00	LOG SUP-1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-00-00-00-00-00	MISSION HARDWAR	956.3	0.0	14.2	55.2	152.1	271.9	290.5	146.3	26.1	.0	0.0	0.0	0.0
11-300-10-00-00-00-00	SPACE PWR SYS	465.4	0.0	14.2	55.2	136.9	162.1	87.9	9.1	0.0	0.0	0.0	0.0	0.0
11-300-10-01-00-00-00	POWER PLATFORM	94.8	0.0	0.0	.6	25.9	42.2	24.2	2.0	0.0	0.0	0.0	0.0	0.0
11-300-10-01-01-00-00	PWR PLT HARDWAR	42.9	0.0	0.0	.3	11.7	19.1	11.0	.9	0.0	0.0	0.0	0.0	0.0
11-300-10-01-02-00-00	PWR PLT ENGR SU	33.3	0.0	0.0	.2	9.1	14.8	8.5	.7	0.0	0.0	0.0	0.0	0.0
11-300-10-01-03-00-00	PWR PLT TOOLING	18.6	0.0	0.0	.1	5.1	8.3	4.8	.4	0.0	0.0	0.0	0.0	0.0
11-300-10-01-03-01-00	COMP BEAM FAB U	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-01-03-02-00	STNGBCK/TURNTAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-01-03-07-00	RCS PACKAGE	18.6	0.0	0.0	.1	5.1	8.3	4.8	.4	0.0	0.0	0.0	0.0	0.0
11-300-10-02-00-00-00	TA-1 ANTENNA	184.5	0.0	7.1	23.7	61.3	63.1	28.2	1.1	0.0	0.0	0.0	0.0	0.0
11-300-10-02-01-00-00	TA-1 ANTENNA-HA	18.4	0.0	2.8	7.9	6.4	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-02-02-00-00	TA-1ENGR SUPPOR	10.2	0.0	1.5	4.4	3.5	.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-02-03-00-00	TA-1TOOLING	18.4	0.0	2.8	7.9	6.4	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-02-03-03-00	TA-1 PALLET	18.4	0.0	2.8	7.9	6.4	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-02-03-08-00	IUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-02-04-00-00	FREE FLT SUPT S	137.5	0.0	0.0	3.5	45.0	59.8	28.2	1.1	0.0	0.0	0.0	0.0	0.0
11-300-10-03-00-00-00	TA-2 ANTENNA	108.5	0.0	0.0	0.0	19.6	47.6	35.4	6.0	0.0	0.0	0.0	0.0	0.0
11-300-10-03-01-00-00	TA-2 ANTENNA-HA	68.6	0.0	0.0	0.0	12.4	30.1	22.4	3.8	0.0	0.0	0.0	0.0	0.0
11-300-10-03-02-00-00	TA-2ENGR SUPPOR	28.3	0.0	0.0	0.0	5.1	12.4	9.2	1.6	0.0	0.0	0.0	0.0	0.0
11-300-10-03-03-00-00	TA-2TOOLING	11.6	0.0	0.0	0.0	2.1	5.1	3.8	.6	0.0	0.0	0.0	0.0	0.0

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FUNDING DISTRIBUTION

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR — FUNDING SCHEDULE — DATE: JUNE 29, 1977
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X NON RECURRING(DDT+E) — RECURRING(PRODUCTION) — RECURRING(OPERATIONS)

DOLLARS IN MILLIONS

WBS NUMBER	WBS NAME	TOTAL	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
11-300-10-03-03-04-00	TA-2 PALLET	11.6	0.0	0.0	0.0	2.1	5.1	3.8	.6	0.0	0.0	0.0	0.0	0.0
11-300-10-04-00-00-00	BMS-SMALL	16.4	0.0	2.5	7.0	5.7	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-04-01-00-00	BMS-SML-HARDWAR	12.0	0.0	1.8	5.2	4.2	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-04-02-00-00	BMS-SML ENGR SU	4.4	0.0	.7	1.9	1.5	.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-05-00-00-00	BMS-360	61.1	0.0	4.6	23.9	24.5	8.1	.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-05-01-00-00	BMS-360-HARDWAR	15.0	0.0	1.1	5.8	6.0	2.0	.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-05-02-00-00	BMS-360 ENGR SU	8.5	0.0	.6	3.3	3.4	1.1	.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-05-03-00-00	BMS-360 TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-05-03-01-00	COMP BEAM FAB U	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-05-03-03-00	TA-1 PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-10-05-04-00-00	FREE FLT SUPT S	37.7	0.0	2.9	14.7	15.1	5.0	.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-20-00-00-00-00	EARTH SERVICES	391.9	0.0	0.0	0.0	.2	67.2	168.2	130.2	26.1	.0	0.0	0.0	0.0
11-300-20-01-00-00-00	30M RADIOMETER	127.8	0.0	0.0	0.0	.2	31.1	56.9	35.8	3.8	0.0	0.0	0.0	0.0
11-300-20-01-01-00-00	30MR HARDWARE	48.3	0.0	0.0	0.0	.1	11.7	21.5	13.5	1.5	0.0	0.0	0.0	0.0
11-300-20-01-02-00-00	30MR ENGR SUPP	28.2	0.0	0.0	0.0	.0	6.9	12.5	7.9	.8	0.0	0.0	0.0	0.0
11-300-20-01-03-00-00	30MR TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-20-01-03-03-00	TA-1 PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-20-01-03-06-00	STRONGBACK EXT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-20-01-03-07-00	RCS PACKAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-20-01-04-00-00	FREE FLT SUPT S	51.3	0.0	0.0	0.0	.0	5.5	10.1	6.3	.7	0.0	0.0	0.0	0.0
11-300-20-02-00-00-00	100M RADIOMETER	140.3	0.0	0.0	0.0	0.0	13.8	57.1	54.1	15.4	.0	0.0	0.0	0.0
11-300-20-02-01-00-00	100MR HARDWARE	21.9	0.0	0.0	0.0	0.0	2.2	8.9	8.4	2.4	.0	0.0	0.0	0.0
11-300-20-02-02-00-00	100MR ENGR SUPP	29.5	0.0	0.0	0.0	0.0	2.9	12.0	11.4	3.2	.0	0.0	0.0	0.0
11-300-20-02-03-00-00	100MR TOOLING	6.5	0.0	0.0	0.0	0.0	.6	2.7	2.5	.7	.0	0.0	0.0	0.0
11-300-20-02-03-02-00	STNGBCK/TURNTAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-20-02-03-06-00	STRONGBACK EXT	6.5	0.0	0.0	0.0	0.0	.6	2.7	2.5	.7	.0	0.0	0.0	0.0
11-300-20-02-03-07-00	RCS PACKAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-20-02-04-00-00	FREE FLT SUPT S	82.6	0.0	0.0	0.0	0.0	8.1	33.6	31.8	9.1	.0	0.0	0.0	0.0
11-300-20-03-00-00-00	27M MBL	123.7	0.0	0.0	0.0	0.0	22.3	54.2	40.4	6.8	0.0	0.0	0.0	0.0
11-300-20-03-01-00-00	27MBL HARDWARE	14.0	0.0	0.0	0.0	0.0	2.5	6.1	4.6	.8	0.0	0.0	0.0	0.0
11-300-20-03-02-00-00	27MBL ENGR SUPP	27.1	0.0	0.0	0.0	0.0	4.9	11.9	8.8	1.5	0.0	0.0	0.0	0.0
11-300-20-03-03-00-00	27MBL TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-20-03-04-00-00	FREE FLT SUPT S	82.6	0.0	0.0	0.0	0.0	14.9	36.2	27.0	4.6	0.0	0.0	0.0	0.0
11-300-30-00-00-00-00	SPACE PROCESSIN	99.0	0.0	0.0	0.0	14.9	42.6	34.4	7.0	0.0	0.0	0.0	0.0	0.0
11-300-30-01-00-00-00	SPACELAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-300-30-02-00-00-00	SPEDF	99.0	0.0	0.0	0.0	14.9	42.6	34.4	7.0	0.0	0.0	0.0	0.0	0.0
11-300-30-02-01-00-00	SPEDF-HARD	64.9	0.0	0.0	0.0	9.8	28.0	22.6	4.6	0.0	0.0	0.0	0.0	0.0
11-300-30-02-02-00-00	SPEDF ENG SUP	34.1	0.0	0.0	0.0	5.1	14.7	11.9	2.4	0.0	0.0	0.0	0.0	0.0

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FUNDING DISTRIBUTION

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR — FUNDING SCHEDULE — DATE: JUNE 29, 1977
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NON RECURRING(DDT+E) | X RECURRING(PRODUCTION) | RECURRING(OPERATIONS)

DOLLARS IN MILLIONS

WBS NUMBER	WBS NAME	TOTAL	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
12-000-00-00-00-00-00	TOTAL PRODUCT;	903,9	0,0	3,0	42,5	105,1	104,9	145,3	270,7	216,8	15,8	0,0	0,0	0,0
12-050-00-00-00-00-00	MANAGEMENT INTE	10,3	0,0	,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	0,0	0,0	0,0
12-100-00-00-00-00-00	SPACE CONSTR BA	192,2	0,0	2,4	40,9	87,4	56,6	4,5	,5	0,0	0,0	0,0	0,0	0,0
12-100-10-00-00-00-00	CONSTRUCTION SY	35,6	0,0	0,0	1,0	17,9	14,9	1,3	,5	0,0	0,0	0,0	0,0	0,0
12-100-10-01-00-00-00	SPACE CONST POD	19,1	0,0	0,0	,6	10,1	8,3	,1	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-01-01-00-00	SUBSYSTEM INTEG	1,7	0,0	0,0	,1	,9	,8	,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-01-02-00-00	STRUCTURE/MECH	7,7	0,0	0,0	,2	4,1	3,3	,1	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-01-03-00-00	EC/LS	5,4	0,0	0,0	,2	2,8	2,3	,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-01-04-00-00	ELECT POWER	,3	0,0	0,0	,0	,1	,1	,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-01-05-00-00	CREW HABIT	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-01-06-00-00	PROPULSION RCS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-01-07-00-00	GUIDANCE + CONT	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-01-08-00-00	INFORMATION	4,1	0,0	0,0	,1	2,1	1,8	,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-02-00-00-00	CRANE	13,8	0,0	0,0	,4	7,3	6,0	,1	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-03-00-00-00	CHERRY PICK PLA	,9	0,0	0,0	,0	,5	,4	,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-10-04-00-00-00	STNGBCK/TURNTAB	1,8	0,0	0,0	0,0	0,0	,2	1,1	,5	0,0	0,0	0,0	0,0	0,0
12-100-20-00-00-00-00	SUPPORT SYSTEMS	122,5	0,0	1,7	31,0	56,5	32,3	1,1	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-01-00-00-00	POWER MODULE	56,7	0,0	1,7	30,0	24,6	,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-01-01-00-00	SUBSYSTEM INTEG	5,2	0,0	,2	2,7	2,2	,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-01-02-00-00	STRUCTURE/MECH	1,9	0,0	,1	1,0	,8	,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-01-03-00-00	EC/LS	,5	0,0	,0	,3	,2	,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-01-04-00-00	ELECT POWER	38,1	0,0	1,1	20,1	16,5	,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-01-05-00-00	FREE FLT SUPT S	11,1	0,0	,3	5,9	4,8	,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-01-06-00-00	PROPULSION/RCS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-01-07-00-00	GUIDANCE + CONT	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-01-08-00-00	INFORMATION	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-02-00-00-00	CONSTRUCTION SH	65,8	0,0	0,0	1,1	31,9	31,9	1,1	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-02-01-00-00	SUBSYSTEM INTEG	6,0	0,0	0,0	,1	2,9	2,9	,1	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-02-02-00-00	STRUCTURE/MECH	12,9	0,0	0,0	,2	6,3	6,3	,2	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-02-03-00-00	EC/LS	15,1	0,0	0,0	,2	7,3	7,3	,2	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-02-04-00-00	ELECT POWER	,3	0,0	0,0	,0	,1	,1	,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-02-05-00-00	CREW HABIT	2,2	0,0	0,0	,0	1,1	1,1	,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-02-06-00-00	PROPULSION/RCS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-02-07-00-00	GUIDANCE + CONT	7,9	0,0	0,0	,1	3,8	3,8	,1	0,0	0,0	0,0	0,0	0,0	0,0
12-100-20-02-08-00-00	INFORMATION	21,4	0,0	0,0	,3	10,4	10,4	,3	0,0	0,0	0,0	0,0	0,0	0,0
12-100-30-00-00-00-00	SCB ENGR SUPPOR	34,1	0,0	,7	8,9	13,0	9,5	2,1	0,0	0,0	0,0	0,0	0,0	0,0
12-100-30-01-00-00-00	PROJECT MGMT	19,2	0,0	,5	4,9	5,9	5,9	2,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-30-02-00-00-00	SYS ENGR + INTE	14,9	0,0	,2	4,0	7,1	3,5	,1	0,0	0,0	0,0	0,0	0,0	0,0
12-100-30-03-00-00-00	GRND SUPT EQUIP	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-30-04-00-00-00	SYS TEST + BVAL	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
12-100-30-05-00-00-00	FACILITIES	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

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FUNDING DISTRIBUTION

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR — FUNDING SCHEDULE — DATE: JUNE 29, 1977
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NON RECURRING(DDT&E) ____ X RECURRING(PRODUCTION) ____ RECURRING(OPERATIONS) ____

DOLLARS IN MILLIONS

WBS NUMBER	WBS NAME	TOTAL	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
12-100-30-06-00-00-00	LOGISTICS (SPAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-100-30-07-00-00-00	LAUNCH OPNS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-100-30-08-00-00-00	FLIGHT OPNS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-00-00-00-00-00	TRANSP SYSTEMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-10-00-00-00-00	SHUTTLE/SCB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-10-01-00-00-00	POWER MODULE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-10-02-00-00-00	CONSTR SHACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-10-03-00-00-00	SPACE CONSTR HD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-10-04-00-00-00	STRONGBACK *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-00-00-00-00	SHUTTLE/MISSION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-01-00-00-00	POWER PLATFORM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-02-00-00-00	TA-1 ANTENNA *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-03-00-00-00	TA-2 ANTENNA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-04-00-00-00	BMS 360	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-05-00-00-00	30M-RADIOMETER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-06-00-00-00	100M RADIOMETER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-07-00-00-00	27M MBL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-08-00-00-00	SPACELAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-09-00-00-00	SP PROC DEVEL F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-20-10-00-00-00	TA-1 FREE FLT S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-30-00-00-00-00	SHUTTLE/LOG SUP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-30-01-00-00-00	LOG SUP-1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-30-02-00-00-00	LOG SUP-1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-30-03-00-00-00	LOG SUP-1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-30-04-00-00-00	LOG SUP-1987	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-30-05-00-00-00	LOG SUP-1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-200-30-06-00-00-00	LOG SUP-1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-00-00-00-00-00	MISSION HARDWAR	701.3	0.0	0.0	.1	16.3	46.9	139.4	268.8	215.4	14.4	0.0	0.0	0.0
12-300-10-00-00-00-00	SPACE PWR SYS	229.6	0.0	0.0	.1	16.3	46.6	112.2	54.0	.4	0.0	0.0	0.0	0.0
12-300-10-01-00-00-00	POWER PLATFORM	70.7	0.0	0.0	0.0	0.0	5.2	42.3	23.2	.0	0.0	0.0	0.0	0.0
12-300-10-01-01-00-00	PWR PLT HARDWAR	48.6	0.0	0.0	0.0	0.0	3.6	29.1	15.9	.0	0.0	0.0	0.0	0.0
12-300-10-01-02-00-00	PWR PLT ENGR SU	14.0	0.0	0.0	0.0	0.0	1.0	8.4	4.6	.0	0.0	0.0	0.0	0.0
12-300-10-01-03-00-00	PWR PLT TOOLING	8.1	0.0	0.0	0.0	0.0	.6	4.9	2.7	.0	0.0	0.0	0.0	0.0
12-300-10-01-03-01-00	COMP BEAM FAB U	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-01-03-02-00	STNGBCK/TURNTAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-01-03-07-00	RCS PACKAGE	8.1	0.0	0.0	0.0	0.0	.6	4.9	2.7	.0	0.0	0.0	0.0	0.0
12-300-10-02-00-00-00	TA-1 ANTENNA	101.3	0.0	0.0	.1	6.6	20.0	55.2	19.4	0.0	0.0	0.0	0.0	0.0
12-300-10-02-01-00-00	TA-1 ANTENNA-HA	11.0	0.0	0.0	.1	4.8	5.8	.3	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-02-02-00-00	TA-1ENGR SUPPOR	3.1	0.0	0.0	.0	1.4	1.7	.1	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-02-03-00-00	TA-1TOOLING	1.0	0.0	0.0	.0	.4	.5	.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-02-03-03-00	TA-1 PALLET	1.0	0.0	0.0	.0	.4	.5	.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-02-03-08-00	IUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-02-04-00-00	FREE FLT SUPT S	86.1	0.0	0.0	0.0	0.0	12.0	54.7	19.4	0.0	0.0	0.0	0.0	0.0
12-300-10-03-00-00-00	TA-2 ANTENNA	23.5	0.0	0.0	0.0	0.0	.4	11.4	11.4	.4	0.0	0.0	0.0	0.0
12-300-10-03-01-00-00	TA-2 ANTENNA-HA	17.5	0.0	0.0	0.0	0.0	.3	8.5	8.5	.3	0.0	0.0	0.0	0.0
12-300-10-03-02-00-00	TA-2ENGR SUPPOR	5.0	0.0	0.0	0.0	0.0	.1	2.4	2.4	.1	0.0	0.0	0.0	0.0
12-300-10-03-03-00-00	TA-2TOOLING	.9	0.0	0.0	0.0	0.0	.0	.5	.5	.0	0.0	0.0	0.0	0.0
12-300-10-03-03-04-00	TA-2 PALLET	.9	0.0	0.0	0.0	0.0	.0	.5	.5	.0	0.0	0.0	0.0	0.0

Table 6-2 (Page 6 of 9)

FUNDING DISTRIBUTION

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR — FUNDING SCHEDULE — DATE: JUNE 29, 1977
CONTRACT NO: NAS9-14928 — DATA FORM C — PAGE: 6 OF

NON RECURRING(DDT-E) — X RECURRING(PRODUCTION) — RECURRING(OPERATIONS)

DOLLARS IN MILLIONS

WBS NUMBER	WBS NAME	TOTAL	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
12-300-10-04-00-00-00	BMS-SMALL	2.1	0.0	0.0	.0	.9	1.1	.1	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-04-01-00-00	BMS-SML-HARDWAR	1.7	0.0	0.0	.0	.7	.9	.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-04-02-00-00	BMS-SML ENGR SU	.5	0.0	0.0	.0	.2	.3	.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-05-00-00-00	BMS-360	32.1	0.0	0.0	0.0	8.8	19.9	3.3	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-05-01-00-00	BMS-360-HARDWAR	9.4	0.0	0.0	0.0	2.6	5.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-05-02-00-00	BMS-360 ENGR SU	2.7	0.0	0.0	0.0	.7	1.7	.3	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-05-03-00-00	BMS-360 TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-05-03-01-00	COMP BEAM FAB U	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-05-03-03-00	TA-1 PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-10-05-04-00-00	FREE FLT SUPT S	20.0	0.0	0.0	0.0	5.5	12.4	2.1	0.0	0.0	0.0	0.0	0.0	0.0
12-300-20-00-00-00-00	EARTH SERVICES	427.6	0.0	0.0	0.0	0.0	0.0	8.0	191.5	213.7	14.4	0.0	0.0	0.0
12-300-20-01-00-00-00	30M RADIOMETER	111.9	0.0	0.0	0.0	0.0	0.0	5.5	63.5	42.7	.2	0.0	0.0	0.0
12-300-20-01-01-00-00	30MR HARDWARE	32.3	0.0	0.0	0.0	0.0	0.0	1.6	18.3	12.3	.1	0.0	0.0	0.0
12-300-20-01-02-00-00	30MR ENGR SUPP	9.3	0.0	0.0	0.0	0.0	0.0	.5	5.3	3.5	.0	0.0	0.0	0.0
12-300-20-01-03-00-00	30MR TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-20-01-03-03-00	TA-1 PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-20-01-03-06-00	STRONGBACK EXT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-20-01-03-07-00	HCS PACKAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-20-01-04-00-00	FREE FLT SUPT S	70.4	0.0	0.0	0.0	0.0	0.0	3.4	39.9	26.9	.2	0.0	0.0	0.0
12-300-20-01-05-00-00	FREE FLT SUPT S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-20-02-00-00-00	100M RADIOMETER	158.7	0.0	0.0	0.0	0.0	0.0	.0	52.1	95.0	11.6	0.0	0.0	0.0
12-300-20-02-01-00-00	100MR HARDWARE	55.1	0.0	0.0	0.0	0.0	0.0	.0	18.1	32.9	4.0	0.0	0.0	0.0
12-300-20-02-02-00-00	100MR ENGR SUPP	15.8	0.0	0.0	0.0	0.0	0.0	.0	5.2	9.5	1.2	0.0	0.0	0.0
12-300-20-02-03-00-00	100MR TOOLING	1.7	0.0	0.0	0.0	0.0	0.0	.0	.5	1.0	.1	0.0	0.0	0.0
12-300-20-02-03-02-00	STNGBCK/TURNTAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-20-02-03-06-00	STRONGBACK EXT	1.7	0.0	0.0	0.0	0.0	0.0	.0	.5	1.0	.1	0.0	0.0	0.0
12-300-20-02-03-07-00	HCS PACKAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-20-02-04-00-00	FREE FLT SUPT S	86.1	0.0	0.0	0.0	0.0	0.0	.0	28.3	51.5	6.3	0.0	0.0	0.0
12-300-20-03-00-00-00	27M MBL	157.0	0.0	0.0	0.0	0.0	0.0	2.5	76.0	76.0	2.5	0.0	0.0	0.0
12-300-20-03-01-00-00	27MBL HARDWARE	55.0	0.0	0.0	0.0	0.0	0.0	.9	26.6	26.6	.9	0.0	0.0	0.0
12-300-20-03-02-00-00	27MBL ENGR SUPP	15.8	0.0	0.0	0.0	0.0	0.0	.3	7.6	7.6	.3	0.0	0.0	0.0
12-300-20-03-03-00-00	27MBL TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-20-03-04-00-00	FREE FLT SUPT S	86.1	0.0	0.0	0.0	0.0	0.0	1.4	41.7	41.7	1.4	0.0	0.0	0.0
12-300-30-00-00-00-00	SPACE PROCESSIN	44.1	0.0	0.0	0.0	0.0	.3	19.2	23.3	1.3	0.0	0.0	0.0	0.0
12-300-30-01-00-00-00	SPACELAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-300-30-02-00-00-00	SPEDF	44.1	0.0	0.0	0.0	0.0	.3	19.2	23.3	1.3	0.0	0.0	0.0	0.0
12-300-30-02-01-00-00	SPEDF-HARD	34.3	0.0	0.0	0.0	0.0	.2	14.9	18.1	1.0	0.0	0.0	0.0	0.0
12-300-30-02-02-00-00	SPEDF ENG SUP	9.8	0.0	0.0	0.0	0.0	.1	4.3	5.2	.3	0.0	0.0	0.0	0.0

Table 6-2 (Page 7 of 9)

FUNDING DISTRIBUTION

STUDY TITLE: PART 3 BASELINE, CS EARLY, 5YR — FUNDING SCHEDULE — DATE: JUNE 29, 1977
CONTRACT NO: NAS9-14958 — DATA FORM C — PAGE: 7 OF

NON RECURRING(DDT+E) — RECURRING(PRODUCTION) — X RECURRING(OPERATIONS)

DOLLARS IN MILLIONS

WBS NUMBER	WBS NAME	TOTAL	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
13-000-00-00-00-00-00	TOTAL OPERAT,	790,0	0,0	0,0	0,0	0,0	21,4	188,1	92,6	149,9	226,3	111,7	0,0	0,0
13-050-00-00-00-00-00	MANAGEMENT INTE	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-00-00-00-00-00	SPACE CONSTR BA	388,9	0,0	0,0	0,0	0,0	21,4	73,5	73,5	73,5	73,5	73,5	0,0	0,0
13-100-10-00-00-00-00	CONSTRUCTION SY	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-01-00-00-00	SPACE CONST MOD	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-01-01-00-00	SUBSYSTEM INTEG	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-01-02-00-00	STRUCTURE/MECH	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-01-03-00-00	EC/LS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-01-04-00-00	ELECT POWER	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-01-05-00-00	CREW HABIT	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-01-06-00-00	PROPULSION RCS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-01-07-00-00	GUIDANCE + CONT	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-01-08-00-00	INFORMATION	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-02-00-00-00	CRANE	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-03-00-00-00	CHERRY PICK PLA	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-10-04-00-00-00	STNGBCK/TURNTAB	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-00-00-00-00	SUPPORT SYSTEMS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-01-00-00-00	POWER MODULE	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-01-01-00-00	SUBSYSTEM INTEG	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-01-02-00-00	STRUCTURE/MECH	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-01-03-00-00	EC/LS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-01-04-00-00	ELECT POWER	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-01-05-00-00	FREE FLT SUPT S	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-01-06-00-00	PROPULSION/RCS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-01-07-00-00	GUIDANCE + CONT	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-01-08-00-00	INFORMATION	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-02-00-00-00	CONSTRUCTION SH	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-02-01-00-00	SUBSYSTEM INTEG	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-02-02-00-00	STRUCTURE/MECH	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-02-03-00-00	EC/LS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-02-04-00-00	ELECT POWER	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-02-05-00-00	CREW HABIT	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-02-06-00-00	PROPULSION/RCS	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-02-07-00-00	GUIDANCE + CONT	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-20-02-08-00-00	INFORMATION	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-30-00-00-00-00	SCB ENGR SUPPOR	388,9	0,0	0,0	0,0	0,0	21,4	73,5	73,5	73,5	73,5	73,5	0,0	0,0
13-100-30-01-00-00-00	PROJECT MGMT	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-30-02-00-00-00	SYS ENGR + INTE	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-30-03-00-00-00	GRND SUPT EQUIP	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-30-04-00-00-00	SYS TEST + EVAL	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13-100-30-05-00-00-00	FACILITIES	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

FUNDING DISTRIBUTION

STUDY TITLE: PART 3 BASELINE, OS EARLY, 5YR — FUNDING SCHEDULE — DATE: JUNE 29, 1977
CONTRACT NO: NAS9-14958 — DATA FORM C — PAGE: 8 OF

NON RECURRING(DDT+E) ____ RECURRING(PRODUCTION) ____ X RECURRING(OPERATIONS)

DOLLARS IN MILLIONS

WBS NUMBER	WBS NAME	TOTAL	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
13-100-30-06-00-00-00	LOGISTICS (SPAR	11.3	0.0	0.0	0.0	0.0	0.0	2.3	2.3	2.3	2.3	2.3	0.0	0.0
13-100-30-07-00-00-00	LAUNCH OPNS	61.0	0.0	0.0	0.0	0.0	6.0	11.0	11.0	11.0	11.0	11.0	0.0	0.0
13-100-30-08-00-00-00	FLIGHT OPNS	314.7	0.0	0.0	0.0	0.0	15.4	60.3	60.3	60.3	60.3	60.3	0.0	0.0
13-200-00-00-00-00-00	TRANSP SYSTEMS	401.1	0.0	0.0	0.0	0.0	0.0	114.6	19.1	76.4	152.8	38.2	0.0	0.0
13-200-10-00-00-00-00	SHUTTLE/SCB	76.4	0.0	0.0	0.0	0.0	0.0	57.3	0.0	19.1	0.0	0.0	0.0	0.0
13-200-10-01-00-00-00	POWER MODULE	19.1	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0	0.0	0.0
13-200-10-02-00-00-00	CONSTR SHACK	19.1	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0	0.0	0.0
13-200-10-03-00-00-00	SPACE CONSTR HD	19.1	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0	0.0	0.0
13-200-10-04-00-00-00	STRONGBACK +	19.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0
13-200-20-00-00-00-00	SHUTTLE/MISSION	324.7	0.0	0.0	0.0	0.0	0.0	57.3	19.1	57.3	152.8	38.2	0.0	0.0
13-200-20-01-00-00-00	POWER PLATFORM	19.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0
13-200-20-02-00-00-00	TA-1 ANTENNA +	19.1	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0	0.0	0.0
13-200-20-03-00-00-00	TA-2 ANTENNA	19.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0
13-200-20-04-00-00-00	BMS 360	19.1	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0	0.0	0.0
13-200-20-05-00-00-00	30M RADIOMETER	19.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0
13-200-20-06-00-00-00	100M RADIOMETER	114.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76.4	38.2	0.0	0.0
13-200-20-07-00-00-00	27M MBL	57.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.3	0.0	0.0	0.0
13-200-20-08-00-00-00	SPACELAB	19.1	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0	0.0	0.0
13-200-20-09-00-00-00	SP PROC DEVEL F	19.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0
13-200-20-10-00-00-00	TA-1 FREE FLT S	19.1	0.0	0.0	0.0	0.0	0.0	0.0	19.1	0.0	0.0	0.0	0.0	0.0
13-200-30-00-00-00-00	SHUTTLE/LOG SUP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-200-30-01-00-00-00	LOG SUP-1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-200-30-02-00-00-00	LOG SUP-1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-200-30-03-00-00-00	LOG SUP-1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-200-30-04-00-00-00	LOG SUP-1987	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-200-30-05-00-00-00	LOG SUP-1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-200-30-06-00-00-00	LOG SUP-1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-00-00-00-00-00	MISSION HARDWAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-00-00-00-00	SPACE PWR SYS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-01-00-00-00	POWER PLATFORM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-01-01-00-00	PWR PLT HARDWAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-01-02-00-00	PWR PLT ENGR SU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-01-03-00-00	PWR PLT TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-01-03-01-00	COMP BEAM FAB U	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-01-03-02-00	STNGBCK/TURNTAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-01-03-07-00	HCS PACKAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-02-00-00-00	TA-1 ANTENNA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-02-01-00-00	TA-1 ANTENNA-HA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-02-02-00-00	TA-1ENGR SUPPOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-02-03-00-00	TA-1TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-02-03-03-00	TA-1 PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-02-03-08-00	IUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-02-04-00-00	FREE FLT SUPT S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-03-00-00-00	TA-2 ANTENNA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-03-01-00-00	TA-2 ANTENNA-HA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-03-02-00-00	TA-2ENGR SUPPOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-03-03-00-00	TA-2TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-03-03-04-00	TA-2 PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6-2 (Page 9 of 9)
FUNDING DISTRIBUTION

STUDY TITLE: PART 3 BASELINE, OS EARLY, 5YR
CONTRACT NO: NAS9-14958

FUNDING SCHEDULE
DATA FORM C

DATE: JUNE 29, 1977
PAGE: 9 OF

NON RECURRING(DDT+E) | RECURRING(PRODUCTION) | X RECURRING(OPERATIONS)

DOLLARS IN MILLIONS

WBS NUMBER	WBS NAME	TOTAL	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
13-300-10-04-00-00-00	BMS-SMALL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-04-01-00-00	BMS-SML-HARDWAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-04-02-00-00	BMS-SML ENGR SU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-05-00-00-00	BMS-360	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-05-01-00-00	BMS-360-HARDWAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-05-02-00-00	BMS-360 ENGR SU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-05-03-00-00	BMS-360 TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-05-03-01-00	COMP BEAM FAB W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-05-03-03-00	TA-1 PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-10-05-04-00-00	FREE FLT SUPT S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-00-00-00-00	EARTH SERVICES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-01-00-00-00	30M RADIOMETER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-01-01-00-00	30MR HARDWARE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-01-02-00-00	30MR ENGR SUPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-01-03-00-00	30MR TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-01-03-03-00	TA-1 PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-01-03-06-00	STRONGBACK EXT1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-01-03-07-00	RCS PACKAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-01-04-00-00	FREE FLT SUPT S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-01-05-00-00	FREE FLT SUPT S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-02-00-00-00	100M RADIOMETER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-02-01-00-00	100MR HARDWARE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-02-02-00-00	100MR ENGR SUPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-02-03-00-00	100MR TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-02-03-02-00	STNGBCK/TURNTAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-02-03-06-00	STRONGBACK EXT1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-02-03-07-00	RCS PACKAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-02-04-00-00	FREE FLT SUPT S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-03-00-00-00	27M MBL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-03-01-00-00	27MBL HARDWARE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-03-02-00-00	27MBL ENGR SUPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-03-03-00-00	27MBL TOOLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-20-03-04-00-00	FREE FLT SUPT S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-30-00-00-00-00	SPACE PROCESSIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-30-01-00-00-00	SPACELAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-30-02-00-00-00	SPEDF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-30-02-01-00-00	SPEDF-HARD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-300-30-02-02-00-00	SPEDF ENG SUP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0